A USER'S MANUAL FOR THE EQUALIZATION OF BOSTON ASSESSMENTS

Prepared for:
The Office of Property Equalization
City of Boston

Prepared by:
Joseph E. Hunt & Co., Inc.

January, 1979

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[illegible] the [illegible] by the [illegible] of [illegible] [illegible] of the City of Boston, [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] Robert [illegible], Director of the Boston [illegible], and [illegible] other City Employees who [illegible] [illegible] [illegible] of the [illegible] [illegible] [illegible].

ACKNOWLEDGEMENTS

This report was made possible by the assistance and support of the Office of Property Equalization of the City of Boston, in particular Messrs. Arthur E. Shea, Director; John Losk, Deputy Director; and Michael Costello, Research Coordinator. We are also indebted and thankful for the assistance and cooperation provided by Barbara G. Cameron, Commissioner of Assessing; Matthew Hanley, Associate Commissioner of Assessing; Robert J. Ryan, Director of the Boston Redevelopment Authority; and many other City employees who supplied services vital to the preparation of this report.

INTRODUCTION TO THE USERS MANUAL

FOR

EQUALIZATION OF BOSTON ASSESSMENTS

In May 1978, Joseph E. Hunt and Company, Inc. entered into a contract with the City of Boston to produce a documented and descriptive Users Manual for the proposed Boston Equalization System. The manual was developed in cooperation with the Office of Property Equalization of the City of Boston.

Specific topics to be researched and made the contents of the Users Manual were:

1. Definition of the Appraisal Process as it relates to mass equalization.
2. Design of Valuation Models.
3. Data Base description, organizations and relationships.
4. Record Design as a computer generated document.
5. Procedure for Data Collection and computer storage.
6. Design of electronic data processing flow systems.
7. Task oriented specifications for computer programming.
8. Administrative requirements for initial and continued operation.

The above contract was understood to be the first phase in the City of Boston in the design and implementation of an automated equalization system for real estate assessment purposes. The project commenced on June 1, 1978 and concluded with submission of this Users Manual on December 1, 1978.

METHODOLOGY

The purpose of Phase I of the project was to design a computer assisted appraisal system capable of equalizing real estate values in the City of Boston for assessment purposes. The consultants' responsibility was to completely design all phases of the system in a manner compatible with accurate appraisal theory and legal statutes controlling assessment practices in the Commonwealth of Massachusetts.

It is the consultants' belief that local development of assessment systems is the best approach to assessment equalization. The alternative method, contracted mass appraisals, has produced numerous examples of incomplete projects or insufficient valuations leading to the loss of taxpayer dollars. Another pitfall of contracted mass appraisal systems has been that local staff, due to lack of involvement and inadequate training, have not been capable of operating and maintaining the system once implemented. As a consequence, the systems have soon become outdated and the need to reappraise has occurred.

The manpower and equipment of most governmental jurisdictions far exceeds the resources of the typical mass appraisal company. These governmental resources, properly organized, are sufficient for the implementation of an equalization system. In addition to the dollar savings that result through the use of existing resources, other advantages are readily apparent. These advantages are expressed in the following five principles on which the consultants have based their approach:

1. The assessment responsibility is a public trust and should not be contracted to individuals not sensitive to local situations or responsible to voters of the jurisdiction.
2. Most jurisdictions have sufficient resources of manpower and equipment to properly create and maintain an assessment/equalization system and if properly organized can do so with in-house capabilities.
3. Employee training necessary for the continued operation of a sophisticated equalization system can best be achieved by active participation in the design and implementation of such a system.
4. In-house development of an equalization system with limited consultant participation maximizes the use of in-house services and as a result significantly reduces the cost of such a project.
5. Continual maintenance is a necessary part of any equalization program and should be a significant part of design and implementation.

ORGANIZATION:

Organization is an integral part of good management. Organization provides the means for action toward goal accomplishments. In setting up a recommended organizational flow chart, emphasis was placed on creating an atmosphere in which decisions could be made in an intelligent and deliberative manner yet without undue procrastination. To achieve this atmosphere, the consultant assembled a team of experts who communicated directly with the Consultant Project Coordinator. The consultant project coordinator in turn communicated with the Director of Equalization for decisions and preliminary approvals.

PERSONNEL:

The consulting team was selected on the basis of individual knowledge and experience at various levels of mass appraisal application, assessor education, and assessment administration. All members of the team have worked together on past projects and have a broad base of experience in the design and implementation of assessment equalization programs. Brief resumes of the consulting team members follow:

JOSEPH E. HUNT, MAI CAE-Project Coodinator

Mr. Hunt has been President of Joseph E. Hunt and Co., Inc. since 1975. He directs the Company's appraisal operations based in Nashville, Tennessee. He participated in the reappraisal program for metropolitan Nashville, Tennessee, a jurisdication containing 175,000 parcels of real estate, and as Assessment Director in Alexandria, Virginia he directed the implementation of a computer assisted appraisal system for that city.

Mr. Hunt has served on the instructors staff of the International Association of Assessing Officers since 1967. He is a member of the Appraisal Institute for the American Institute of Real Estate Appraisers and is a Certified Assessment Evaluator, sanctioned by the International Association of Assessing Officers. He received the "I" award for new ideas in public information presented by the International Association of Assessing Officers and was named Assessor of the Year by the Tennessee Association of Assessing Officers.

Publicatons include the following:

1. "General Recommendations for Legislative Action", vol. 8, No. 3 Assessors Journal, October, 1977, IAAO.
2. "A Multi-Jurisdictional Approach to Computerized Assessments" a case study, August, 1975, the International Assessor, vol. 41, No. 8.
3. "A National Educational Program, Conformity Amidst Diversity", proceedings of the "International Conference on Assessment Administration", Miami, Florida.

MORGAN B. GILREATH, JR., MA-Valuation and Administration Advisor

Mr. Gilreath is in private practice with a firm located in Athens, Georgia. He is active in property consulting in the areas of property taxation, investment analysis, real estate appraisals, real estate training seminars and feasibility analysis studies.

Mr. Gilreath spent six years on the faculty of the University of Georgia's Institute of Government working with the Georgia State Department of Revenue in the area of Property Taxation. Mr. Gilreath designed the certification educational program for Assessors in Georgia which included writing course materials, designing Short Courses, and instruction. He also provides technical assistance to Georgia county governments and has served as a property tax advisor to the state Revenue Department and Governor's Office.

Mr. Gilreath is a Senior Instructor for the International Association of Assessing Officers (IAAO), qualified to teach three of their advanced courses (2, 202, and 301). He served on a Curriculum Development Task Force for the IAAO and assisted in developing their newest books in Property Assessment Valuation and Assessment Standard Practices. He has also presented a number of papers for the IAAO at various locations throughout the country and has published articles in the International Assessor and the Assessor's Journal.

Publications are as follow:

1. Master's Thesis: "The Conversion of Apartments to Condominiums: An Application of Cash Flow Decision Models" (174 pages).
2. "Apartment to Condominium Conversions", The Real Estate Appraiser, May-June, 1974, SREA (co authored with Dr. Paul F. Wendt, MAI).
3. Assisted in the development of the 2nd edition, The Property Taxation Laws of Georgia, 1975, Institute of Government, University of Georgia.

4. Co-editor and project director, Handbook for Georgia Tax Commissioners, 1975, Institute of Government, University of Georgia.

5. "A Hard Look at the Ad Valorem Tax", Georgia County Government Magazine, March, 1977, The Association of County Commissioners of Georgia.

6. Reprint of above article in the International Assessor, March, 1978, The International Association of Assessing Officers.

7. Contributing Editor, "Property Assessment Valuation", 1976, the International Association of Assessing Officers.

8. Contributing Editor, "Improving Assessment Standards and Practices, 1978, the International Association of Assessing Officers.

9. "The Valuation of Partial Interests", The Assessor's Journal, June, 1978, The International Association of Assessing Officers.

10. Paper on "Leasehold Interests", Southern Association of Tax Administrators, Atlanta, Georgia, July, 1977.

11. Paper on "Valuation of Partial Interest", Professional Seminar, IAAO, SREA, AIREA, Portland, Oregon, September, 1977.

12. Presentation of various topics at the Georgia Association of Assessing Officers Annual Conference, Jekyll Island, Georgia, 1972-1978.

13. Paper on "Perspectives on the Income Approach", Workshop on New Developments in the Appraisal of Income Properties, San Francisco, California, April, 1978 and Arlington, Virginia, November, 1978.
14. Paper on "Estimating Discount and Field Rates", Workshop on New Developments in the Appraisal Income Properties, San Francisco, California, and Arlington, Virginia, November, 1978.
15. Paper on "Mortgage Equity Analysis", Workshop on New Developments in the Appraisal of Income Properties, San Francisco, California, April, 1978, and Arlington, Virginia, November, 1978.

MICHAEL S. SKAFF, Ph.D-Electronic Data Processing Advisor

Dr. Skaff is currently a member of the faculty at the University of Detroit, Detroit, Michigan. He has been active in the field of computerized assessments since 1968, and he was Project Coordinator for the Alexandria, Virginia - Arlington, Virginia computerized assessment. Dr. Skaff has been instrumental in the design and development of several computer based models related to mass appraisal of real estate and management support of governmental applications. A list of involvements follows:

- City of Grand Rapids, Michigan - Design and Development of a real time information system, automation of the Water and Assessor's Offices.

- City of Highland Park, Michigan - Design of an Assessor's property tax system.
- City of Detroit, Michigan - Board of Assessor's Personnel property tax case expert witness.
- City of Harper Woods, Michigan - Study of Data Processing Requirements and Information needs, evaluation of potential Computer System.
- City of Alexandria and County of Arlington, Virginia - Design and Implementation of Computer Assisted Appraisal System.
- Lecturer and Technical Staff member, International Association of Assessing Officers, Taught courses and seminars both in the United States and Canada.
- Lecturer for the Lincoln Institute for Land Policy, Harvard University, Taught courses and seminars.
- Harrison Township, Michigan - Design and implementation of a Tax and Water billing information system using desk top computers.

Publications include the following:

1. "A Property Tax Information System", Assessor's Journal, 6 (1971) 2, 43-50.
2. "A Non-Linear Property Tax Valuation Model", Proceeding URISA National Conference, San Francisco, September, 1972.

3. "A Case Report in Assessment Administration: A New Valuation Technique", The Michigan Assessor, 13 (1972) 9.

4. "A Non-Linear Regression Analysis of Sales Data-A New Valuation Technique", Assessor's Journal, January, 1973, 35-49.

5. "The City of Grand Rapids Property Tax Information System: A Case Report", Proceedings of the 39th International Conference on Assessment Administration, vol. 6, 294-302.

6. "A Personal Property Tax Model to Determine Average Service Life for Machinery and Equipment", Assessor's Journal, July, 1974, 3-12 Co-Author, John M. Dwyer.

7. "Implication of Multicollinearity and Interactive Effects in the Predictive Ability of a Mass Appraisal Model", The Application of Multiple Regression Analysis in Assessment Administration, Proceedings of Symposium by IAAO and John C. Lincoln Institute, Lake Bluff, Illinois, July, 1974, 80-92.

8. "Computerized Personal Property Valuation Models", Proceedings of the 40th International Conference on Assessment Administration, September, 1974, 194-201.

9. "The Search for Comparable Sales: A New Approach", Assessor's Journal, April, 1975, 7-16.

10. "A Multi-Jurisdictional Approach to Computerized Assess ments", the International Assessor, vol. 41, No. 9, September, 1975, 163-169.

11. "Automation in Small Taxing Jurisdictions: A New Alternative", Michigan Assessor, 18 (1977) 4, 16-19.

12. "Automation in Small Taxing Jurisdictions", Assessor's Journal, September, 1977, 157-170.

MANUAL CONTENTS

This Users Manual contains definitive information necessary to implement a computer assisted mass appraisal system. The chapters present "state of the art" methods of valuation and administration, designed for use by the administrator, and by supervisory and field personnel.

The Valuation Chapter presents detailed data relating to the appraisal of real estate. Each specific section presents a practical method of application and the manner in which the approach should be automated. Included are the Cost Approach to Value, Land Valuation, the Market Approach to Value, the Income Approach to Value and Performance Analysis.

The Data Base Design Chapter presents a description of 115 data base items which are divided into residential property, commercial property and sales analysis file subsections.

The Automated Systems Design Chapter presents three necessary components requisite to proper implementation of an automated equalization program:

1. Automated System Development Phases - describing the framework which should be utilized in developing automated support for the Equalization System.

2. System Requirements - defining what the anticipated automated support of the system should contain, includes flow charts.
3. System Design Considerations - alternative courses of action are developed for major decisions affecting the system.

The Data Collection Chapter presents a detailed description of the data collection program which must be an integral part of the initial equalization effort. This chapter provides detailed descriptions of the four major areas involved in data collection:

1. Neighborhood Delineation: A division of the city into geographical "neighborhoods" for purposes of data collection and valuation.
2. Field Operations: Descriptions of organization and work flow of the on-the-site field operations during implementation.
3. Quality Control: Maintaining the highest degree of accuracy and integrity in the data collection phase.
4. Phase Delineation for Implementation: The general chronological flow of implementation of the equalization program.

The System Testing Chapter presents a description of the personnel required, methods to be employed, timing and work flow for an in-depth simulation of the program after data collection but prior to full implementation. The major areas discussed include:

1. Assignment of Personnel: Number, job description and organization of teams of testing personnel.
2. Data Collection. The field data collection on randomly selected properties.

3. Program Testing-Valuation Models: Running test data through the systems EDP programs.

The Administration Chapter depicts the Equalization Systems in an orderly flow, identifying work modules and addressing the administrative considerations required in the operation of an ongoing system. The chapter views the equalization process from the vantage point of an administrator in two phases:

1. Development of the Equalization System: All of the considerations necessary for development of a mass appraisal equalization system.
2. System Operation and Maintenance: The organization of personnel, equipment and systems in a manner that will allow for continual production of equalized valuations on an annual basis.

REPORT RECOMMENDATIONS

In one regard, the entire report may be viewed as a continuous recommendation for implementation. The items presented below are considered prerequisites to the development of an equalization program which can be developed in-house and maintained on an indefinite basis.

1. Remapping of the City of Boston: It is recommended that prior to implementation of an equalization program, the entire city be remapped. In the consultants' opinion, ideal specifications for a new mapping system should concentrate in the following areas:

Aerial photographs with requirements in equipment and ground controls for producing the highest possible degree of accuracy in orthophotographs.

Development of base maps utilizing the state plane coordinate system and depicting all physical features including land improvements.

Placement of property lines as per original maps and deed abstraction. Accurate specifications and method for solving discrepancies.

Map contents as related to assessor's needs and other governmental agencies.

Map quality with regard to drafting standards and materials.

Development of a workable numbering system and maintainance procedures.

Map scale and computations.

More complete specifications for a mapping program have been included in the Addendum to this report.

2. <u>Data Collection Effort</u>: It is recommended that the City embark on an extensive data collection program, as outlined in this report. This will involve field visits to all real estate parcels in the city to include measurement of all improved properties and collection of all data items (as herein described) necessary for valuation purposes. A proper data collection program, with the number of personnel proposed in this report, will require a minimum time commitment of two years.

3. <u>Systems Development and Programming</u>: The requirements for systems design are presented in the body of this report. The actual development and programming, if begun in conjunction with a data collection program, should be in operational form by the end of the field collection phase. This recommendation encompasses the hiring of an adequate systems and programming staff, physically writing programs and testing the system once complete.

The consultants realize the brevity of the comments concerning each recommendation. It is our intent, however, that these statements serve as an overview of the contents of this report, not as a substitute for them.

READERS NOTE:

The reader will encounter many definitional terms in the body of this manual. The consultants have used these terms in a manner consistent with the policies of the Joint Terminology Committee of the American Institute of Real Estate Appraisers and the Society of Real Estate Appraisers.

Where the consultants felt that special emphasis was required, particular phrases were set off in quotation marks. However, no footnotes have been used since the sole sources were:

(1) Real Estate Appraisal Terminology, Byrl N. Boyce. Ballinger Publishing Company, Cambridge, Mass. 1975.

(2) Improving Real Property Assessment, A Reference Manual, The International Association of Assessing Officers, Chicago, Ill., 1978.

A User's Manual For The Equalization Of Boston Assessments

Table of Contents

CHAPTER ONE - VALUATION MODELS

I. INTRODUCTION TO VALUATION MODELS

There are three traditional approaches for the valuation of real estate: the Cost Approach, the Market Data (or Comparative Sales) Approach and the Income Approach.

The Market Approach assumes that buyers and sellers, aggregately, act rationally and pay no more for a particular property than they would pay in another, similar neighborhood for an equally desirable, comparable property. The basic concept is, then, that prices of sold properties may be used in determining the value of similar properties which have not been sold. The Market Approach to value is used, indirectly, in both the Cost and Income Approaches. The Market Approach, in the Boston System, will be evident in the Multiple Regression Analysis Subsystem, the Market Analysis Subsystem, and in the valuation of land.

The Cost Approach utilizes current construction costs for similar properties, allowing sufficient depreciation for each specific property appraised depending on age, condition, and economic factors. These costs are market costs in that they are derived from the current construction market. As designed for the Boston Equalization System, market sales will be utilized in checking the accuracy of cost information as it relates to market value, since cost does not always equal value. The Market Approach is further utilized in the Cost Approach in that all land is valued by the Comparative Sales Method. The advantage of utilizing a cost methodology in mass appraising is that it can be applied to all improved properties; it is easy to use and easy to explain to the public; and it is adaptable for computer application.

The Income Approach utilizes rent (or income) as the prime ingredient in determining value. The market-place has consistantly shown that the price a willing buyer will pay a willing seller for a parcel of commercial property is a function of the income produced by that property. The Income Approach recommended for the City of Boston applies this basic concept to the mass of properties in Boston.

It is also recommended that all properties valued by the Income Approach also be valued by way of the Cost Approach to insure city-wide equalized assessments of commercial property.

The Specific Valuation Modules designed for the Boston Equalization System are:

1) The Cost Approach
2) The Market Approach
3) The Income Approach
4) Land Valuation
5) Unique Property Valuation
6) Performance Analysis

II. THE COST APPROACH

A. Introduction

The Cost Approach to value is defined as "that approach in appraisal analysis which is based on the proposition that the informed purchaser would pay no more for the cost of producing a substitute property with the same utility as the subject property. It is particularly applicable when the property being appraised involves relatively new improvements which represent the highest and best use of land or when relatively unique or specialized improvements are located on the site for which there exists no comparable properties on the market."

The Cost Approach is applied by estimating all component costs involved in the construction of a particular building. The value is determined by adding all the component costs and then subtracting accumulated depreciation.

The Cost Approach is the most utilized valuation method in the mass appraisal of properties because of its thoroughness and descriptive detail, and its almost universal application to all improved properties.

In estimating costs, both direct costs (i.e., actual construction costs) and indirect costs (legal fees, insurance, financing, etc.) must be evaluated.

The component costs can either be generated by the assessing jurisdiction itself or may be obtained through subscription to a national cost service. Many smaller assessing jurisdictions in the

United States (i.e., under 150,000 parcels) find it more economical to subscribe to a national system which provides continuous updates rather than build and maintain their own cost data. (See further discussion in Section II E.)

Cost systems may be built to provide either the reproduction cost (i.e., physical re-construction) or replacement cost (i.e., the replacement of the building's utility value using current technology and materials). Because reproduction cost is virtually impossible to estimate on older structures found in the Boston market and its use causes redundant calculations of depreciation, this approach will not be used in the system.

The system designed for the City of Boston uses the replacement cost method, utilizing up-to-date local cost estimates.

B. Overview of Mass Appraisal Application

The cost approach is universally applicable because the construction of all improved properties involves basic construction cost. There are many degrees of detail which can be encountered in estimating costs. The "engineering breakdown" method reviews the cost of every nail, board, window, door, etc. in a detailed enumeration of costs. The "segregated cost" method examines the costs of constructing various components of a structure. For example, the segregated cost method would present a separate cost (lump sum or per square foot of living area) for the various components of a structure such as:

Cost Component	Cost	X	Number of Square Feet	=	Cost Per Square Foot
Foundation	-		-		-
Basement	-		-		-
Floor Structure	-		-		-
Plumbing	-		-		-
Heating	-		-		-
Air Conditioning	-		-		-
Interior Construction	-		-		-
Electrical	-		-		-
Exterior Wall	-		-		-
Roof	-		-		-
					=Base Cost Per Sq. Ft.

While there are additions for built-in items and for variations within the above presentation, it is possible to group structures according to the type, manner and quality of construction. The example above illustrates that a "base cost per square foot" may be arrived at through the summation of the component costs which go into its construction. Once "base costs" for similar property types have been established, they may be used to estimate the replacement cost of other similar structures. If, for example, one knew the components of a single family house, and also knew the cost of these items, an estimate would not be difficult to obtain. Although this is a simplified way of viewing it, the valuation of a large number of properties may be accomplished by utilizing established base costs for different property types with a high degree of accuracy.

It is through this basic concept that the cost approach has its greatest appeal to the mass appraisal of properties. Initially, costs may be obtained for any type of property. Then, any given type of property may be broken down into "quality classes" or "grades" (i.e., type: residential single-family; grade: average). Further, costs of construction may also be broken down into costs for a particular property type and grade/classification. Then, the actual components of construction (data base items) for which costs have already been gathered may be acquired on all properties through a massive data collection effort. This means that the necessary construction components collected in the field be kept as permanent records. These items may then be merged with the actual cost data (dollars per square foot, etc.) to produce estimates of value on large numbers of properties. This type of system may be kept current by constantly updating cost data and keeping up with all new construction and modifications.

This type of mass appraisal system, once implemented, is relatively easy to administer and maintain. It also provides equal treatment to all property owners whose properties are similar with regard to size, location and physical characteristics.

C. Grading System

The most important factor to be built into any mass appraisal system is that of equalization. This simply means that property owners with properties that are similar in size, location, physical characteristics and quality of construction, should be valued by similar valuation methods. In the cost approach, equalization is maximized by having the same cost factors used on buildings of similar size, design and structural quality.

Very few structures are built as exact replicas of each other so the use of similar valuation schedules on varied structures may, at first, seem unrealistic. It is, however, possible to stratify the various types of building construction within a property type into building "classes" or "grades". This will enable the valuation process, utilizing the cost approach, to closely approximate uniformity for buildings of similar sizes and types. This system forces data collectors and appraisers to view the components of the property more closely. The classes which are recommended for the City of Boston are:

- Low Quality
- Fair Quality
- Average Quality
- Good Quality
- Very Good Quality

A valuation system which assigns a "grade" or "quality class", such as those presented above, to each property type assures uniform valuation treatment of each property within each of the classifications. Cost figures can be developed for each grade in a manner similar to that set forth previously. Another advantage of a grading system is the flexibility it allows in computerization.

The selection of the appropriate building grade or class is one of the most important phases of the cost approach. It is here that the appraiser "keys" the process toward the appropriate costs developed for a particular grade or class. Over-grading of a structure will result in overvaluation while under-grading will result in undervaluation. In either instance, the desired result of equalization and uniformity has been lost when the appraiser improperly grades a structure.

It should be emphasized that the selection of a grade or class is dependent on the quality of materials and workmanship which are evident upon physical inspection. The quality of a house, for example, should not be confused with the condition of a house. The condition will manifest itself in the wear and tear of the structure through the aging process (and the manner in which the property has been maintained). Condition will be accommodated in the system in the form of depreciation. Depreciation will be estimated by the appraisers establishing the "effective age" of the structure. A depreciation table will be contained in the system. For each year of effective age estimated, there will be a corresponding percent of depreciation. A depreciation table is one type of many table files that will be used by the system. Table files contain stored indicators of value used in the appraisal process. They are constructed by analyzing arms length market sales for indications of value and storing the value indicators in manual or computer table files. Examples are, cost tables, depreciation charts, land values, income and expense estimates and capitalization rates.

Depreciation stems from three basic sources. The first is physical deterioration (actual wear and tear). The second is functional obsolescence, which may be attributed to poor floor plan, inadequacy due to size or architectural design, position of the building on the lot, etc. The third is economic (locational) obsolescence, which is caused by influences outside the property, such as changes in zoning, economic conditions, anticipated change in land use, etc. These elements of depreciation may not be estimated individually for each property since mass appraisal, by definition, requires that all properties be valued as quickly and economically as possible while maintaining uniformity. Hence, depreciation tables which are based on the theory that the above types of depreciation will tend to occur at a fairly constant rate on properties with similar characteristics will be used.

The choice of the grade for any given building should possess as little subjectivity as possible. The recommended system minimizes the "judgement calls" of the field appraiser and results in a grade which is highly quantifiable. As illustrated below, points are assigned for each quality grade. Points are also assigned for the various components of the structure. The total points divided by the number of items will yield an average grade for the overall structure. The rating is as follows:

GRADE	POINTS
Low Quality	2
Fair Quality	3
Average Quality	4
Good Quality	5
Very Good Quality	6

As stated, the appraiser assigns a point value according to the quality of each component part of the building. It is not unusual to have a different point value assigned to each component part. A summation of points and a simple average will determine the classification according to the point schedule above. The following charts will illustrate the grading points for specified details of construction in twelve components of a building.

GRADING POINT SYSTEM

COMPONENT	GRADES
Foundation	2 (poor) to 6 (excellent)
Walls	2 (poor) to 6 (excellent)
Roof Cover	2 (poor) to 6 (excellent)
Gutters and Downspouts	2 (poor) to 6 (excellent)
Floors	2 (poor) to 6 (excellent)
Walls and Ceiling	2 (poor) to 6 (excellent)
Millwork	2 (poor) to 6 (excellent)
Heating System	2 (poor) to 6 (excellent)
Electric System	2 (poor) to 6 (excellent)
Plumbing	2 (poor) to 6 (excellent)
Kitchen Equipment	2 (poor) to 6 (excellent)
Individual Architectural Design	2 (poor) to 6 (excellent)

PROBABLE OCCURRENCE OR VARIOUS CONSTRUCTION FEATURES

	2	3	4	5	6
	POOR	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	EXELLENT
MILLWORK	No trim, box trim, 1-3/8" 1-panel stock door	Some stock trim 1-3/8" 1-panel or hollow core slab doors, joints poorly mitered or butt jointed	Stock trim 1-3/8" birch slab doors, wood or steel casement windows screens wood or marble sills.	Full trim of birch or gun 1 3/4" birch or mahogany slab or raised panel colonial doors, wood or alum. windows, marble sills, screens	Special custom-built mill-work throughout, including built-in cabinet work in several rooms, screens
HEATING SYSTEM	No central heating plant (stove heat)	Stove heat, flr furnace, pipe-less or gravity warm air, hand fired, wall furnace (min-imum duct work)	Forced warm air, flr. furnace where climate permits, automatic gas oil or stoker fired	Well designed forced warm air system, hot water or steam radiant automatic gas, oil or stoker fired, possibly air-cond. where climate requires	Hot water, steam or radiant heat, gas or oil fired with special climatic temperature control system. Air cond. where climate requires possibly electric heat pump
ELECTRIC SYSTEM	No flr. or wall outlet, knob & tube system. few cheap drop lights	Mimimum # wall or flr. outlets knob or tube or nonamored cable, cheap fixtures	Acceptable #. wall or flr. outlets, nonarmored cable (knob & tube old houses only). Possibly low-voltage system, average fixtures.	Ample outlets for max. convenience, armored or non-armored cable. Low voltage system, high grade fixtures ample circuits with provision for heavy duty require-ments.	Ample outlets for max. conven-ience, armored cable or rigid conduit, mas. no circuits with provision for heavy-duty requirements. low-voltage system, very expensive fixtures.
PLUMBING	Galv. vater line minimum quality fixtrs. cheap 3-fixture bath plus kit sink,	Gal. water line minimum quality fxtrs occasionally color fxtrs, below average auto. hot water heater	Gal. or copper water line, aver. fxtrs, with china lavatory, often has color fxtrs, modern house could have livin-ettes, average grade auto. hot water heater	Copper water line better than average fxts, with china lavatory, possibly color. Modern houses would probably have lavinettes.	Copper water line. Excellent china fixtures, noisless flush, color fixtures, lavinettes often double bowls.

PROBABLE OCCURRENCE OF VARIOUS CONSTRUCTION FRATURES

	2	3	4	5	6
	POOR	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	EXELLENT
KITCHEN EQUIPMENT	None	1 or 2 stock cabinets new homes may have more cheap cabinets, some-times inexpen-sive built-in oven & range	Acceptable assortment of stock cabinets pos-sibly vent fan & disposal, new homes with built-in oven and range	Ample cabinets such elec. equipment as vent fan, disposal, dish washer, built-in ovens and burners	Custom designed kit. all equipment, built-in according to plan
INDIVIDUAL ARCHITECTUR-AL DESIGN	No	No	Mostly stock plans	Yes	Always
FOUNDATION	Wood posts, masonry piers, conc. piers	Cheap conc. blk blk. job light slab, continuous peri-meter footing	Conc. slab, conc. blk. apron on continuous peri-meter footing	Continuous preimeter footing, 18" stone, 10" - 12" conc. foundation wall, well-formed conc. slab	Continuous perimeter footings, 18" stone, 12" conc., 18" brk. faced conc., well-formed conc. slab
WALLS	Novelty siding, asbes. siding, 8" conc. blk., single wall. fr. siding	Cheap stucco, below-aver. fr. siding over sheathing, novel-ty siding, poor br. or conc. blk. job	Manfactured br., aver. fr. siding over sheathing cedar shake brk. veneer, aluminum siding.stucco on metal lath, perhaps all insulated	High quality fr. or brk. beneer over sheathing well-insulated stone veneer, 12" brk., stucco over masonry, 8" brk. with insulated 2" furring	12" -18" brk. with orna-mental stone cut stone superior brk. veneer job best grade clapboard or single occasion-ally excellent stucco job over masonry
ROOF COVER	Asphalt roll tar paper, corrugated iron	Light asph. shgl. metal (crimped copper), tar & grav., asph roll	Av. wt. asph. shgl., metal (crimped copper), built-up tar & gravel	Heavy wt. asph. shgl., metal (crimped copper), built-up tar & gravel, wood shgl, asbes shgl., slate tile	Heavy wood shgl., asbes. shgl., slate, tile, heavy wt. asph. shgl.

PROBABLE OCCURRENCE OF VARIOUS CONSTRUCTION FEATURES

	2 POOR	3 BELOW AVERAGE	4 AVERAGE	5 ABOVE AVERAGE	6 EXELLENT
GUTTER & DOWNSPOUTS	No	Perhaps galv., but mostly none at all	Galv. or none where roof overhang passes FHA specifications	Galv. or copper	Copper
Floors	Y. pine single bath linoleum	Y. pone maple, double flr. asph. tile, bath linoleum	#1 T & G hardwood or maple aver. vinyl occasionally quarry tile hall-den ceramic tile bath	Select or fance hardwd., plywd. where wall/wall carpeting used, den halls & kit. may quarry tile or superior vinyl. ceramic tile bath	Clear oak. fancy hardwd., much terrazzo, mable or other special flooring
WALLS & CEILING	No finish, or rough beaverbd. or car siding	Thin drywall or 2-coat plas. on older homes, possibly taped beaverbd. or car siding, alum. or plastic tile bath waims.	Top quality drywall job aver. 3-coat plaster, ceramic tile waims in bath, frequently wood paneling in den or kit	3-coat plas. some wood paneling, ceramic tile bath waims., 5/8" drywall or laminated drywall	3-coat plas. posibly canvas, excellent wood paneling ceramic tile kit. and bath walls. double thicknesss drywall

The following example illustrates how the construction details may be used to determine the quality grade on a given structure.

GRADING EXAMPLE

	Building Specifications	Point Rating
Foundation	10" concrete block	4
Exterior Walls	Average frame siding over sheathing	4
Roof Covering	Tile	5
Gutters & Downspouts	Copper	5
Floors	Fancy hardwood	5
Walls & Ceiling	Two coats plaster, ceramic tile tub enclosure	4
Millwork	Stock trim, 1-3/4" birch slab doors, double hung wood windows, screens	4
Heating System	Hot water system with automatic oil	4
Electric System	Rigid conduit, low-voltage system, high grade fixtures	5
Plumbing	Copper water line, better than average fixtures	5
Kitchen Equipment	Stock cabinets	5
Individual Architectural Design	Yes	5
	Total points (all fixtures)	54
	Average of 12 items	4.5
	Class	4+

D. Steps in the Cost Approach

The application of the Cost Approach involves steps which are uniformly accepted and applied by all real estate appraisal practitioners. For mass appraisal purposes, a Market Adjustment Factor (MAF) has been incorporated to produce a Market-Orientated Cost Approach. This step is necessary because properties are valued on a neighborhood basis and the MAF is to explain neighborhood variations in value.

These steps are:

Step No. 1	Replacement Cost New (RCN)
Step No. 2	Accrued Depreciation
Step No. 3	Replacement Cost New Less Depreciation (RCNLD)
Step No. 4	Market Adjustment Factor
Step No. 5	Land Valuation

STEP NO. 1 - REPLACEMENT COST NEW (RCN)

The estimation of the RCN for any improved property requires the collection of all data elements which will be utilized in the valuation process (i.e., building construction type, grade classification, exterior wall type, roof type, number of square feet, etc.). These items comprise a major part of what is referred to as the "Data Base" and they are called "data base elements". The data base elements for both the residential and commerical (which includes industrial, office, apartments, etc.) properties are provided in detail in the Data Base Design Chapter of this report. These elements, which are cost related, are merged within the valuation sub-system into a composite estimate of RCN. These data base elements are stored in the Parcel Master File for retrieval and application in the valuation process. The process of estimating the total RCN involves the following general steps:

(a) Collection of Data Base Elements

(b) Determination of Building Grade

(c) Application of Base Cost per Square Foot Method of RCN Estimation

The collection of data base elements is detailed in the Data Collection Chapter of this report. It involves the physical measurement of all improvements (structures) and the recording of all the physical and locational charateristics which make up the entirety of the Data Base.

The determination of the grade for each property must be performed by an experienced appraiser.

The grade of an improvement relates to the quality of materials and workmanship contained in the building. There is a distinction, as mentioned in the previous section, between grade and condition. Grade is an indication of the relative quality of materials and workmanship used in the construction of the property while condition represents the physical state of the property resulting from the degree of maintenance and normal wear and tear associated with age. The condition of the structure may indicate the grade, but it is always indicative of loss of value due to physical deterioration. For example, a cracked foundation or sagging floors should be noted as an indication of deterioration (condition) which may have been caused by substandard construction (grade). Building types assigned to the various grades depend on the appraisal system to be utilized.

The Base Cost per Square Foot Method provides the most applicable procedure for estimating cost when attempting to appraise properties in the mass. It involves combining the number of square feet in any given structure with the appropriate typical costs for that particular property type and grade. The Base Cost encompasses all costs for property characteristics common to all structures. The system will then allow for additions or deletions to the base cost for items which may not have been included in the estimation of the basic square foot rate. Other additions to this amount will be in the form of "lump sum" adjustments for fireplaces, built-in features, garages or structures on the property.

STEP NO. 2 - ACCRUED DEPRECIATION

Accrued depreciation refers to the total amount of depreciation which has accumulated due to deterioration and/or obsolescence. Depreciation is defined as, "a loss of utility and hence value from any cause...deterioration or physical depreciation is evidenced by wear and tear, decay, dry rot, cracks, incrustations, or structural defects. Obsolescence is divisible into two parts, functional and economic. Functional obsolescence may be due to poor plan, mechanical inadequacy or super-adequacy, functional inadequacy, or super-adequacy due to size, style, age, etc. It is evidenced by conditions within the property. Economic obsolescence is caused by changes external to the property".

There are several methods of estimating depreciation, the selection is determined by the availability of reliable information and the type of appraisal. It is recommended that the Boston appraisal system utilize depreciation tables relying on comparable market information to justify and support their use. The comparative sales method of estimating depreciation is explained in the Market Approach Section of this Chapter (see Section IV.). Formulation of depreciation tables requires a comparison between the RCN of an improvement and the sales price of the improvements (with land and associated land costs abstracted from the sales price). The estimation of accrued depreciation involves a determination of the "effective age" of a structure, as well as the actual age. Effective age is defined as "...the age if a similar structure of equivalent utility, condition, and remaining life expectancy as distinct from chronological age; the years of age indicated by the condition and utility of the structure. If a building has had better than average maintenance, its effective age may be less than actual age; if there has been inadequate maintenance, it may be greater. A 40-year old building may have an effective age of 20 years due to rehabilitation or modernization". The effective age is also cross referenced with market analysis for purposes of verification.

As explained in the Market Approach Section of this Chapter, use of the depreciation tables is recommended for the City of Boston with the provision that market information be monitored over time for purposes of checking both the estimate of depreciation and the estimate of effective age. This method of combining market information with depreciation tables minimizes any errors which might result from standard tables or from any estimates of effective age.

Depreciation as explained thus far is primarily "physical deterioration". The Boston system will also have the capability of manually inputting a percentage (of RCN) for any observed functional obsolescence. Economic obsolescence, however, is caused by external factors which tend to affect more than one property. Because of this, decisions regarding economic obsolescence should be made at a neighborhood level.

STEP NO. 3 REPLACEMENT COST NEW LESS DEPRECIATION (RCNLD):

The estimation of Replacement Cost New Less Depreciation (RCNLD) is the subtraction of the accrued depreciation from the previously established RCN.

STEP NO. 4 APPLICATION OF MARKET ADJUSTMENT FACTOR:

The next step in the cost approach involves an interfacing with the sales analysis file (described in Section IV). The Market Adjustment Factor (MAF which has been calculated separately) is applied to "localize" the RCNLD to the neighborhood being appraised. (For definition of MAF, see Step 7 of Residential Costing Procedures.)

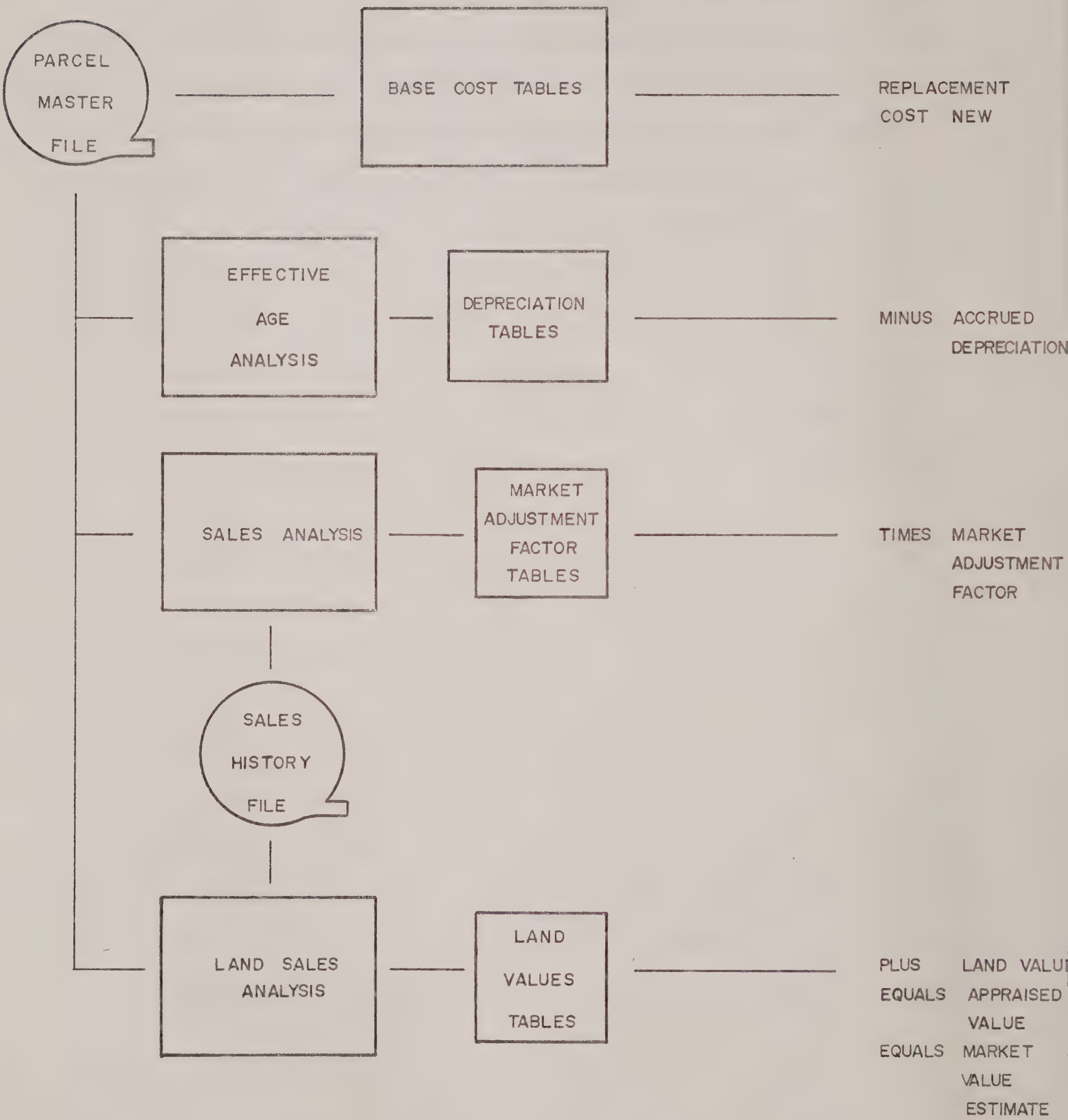
The MAF is only applied to the RCNLD because the land is valued separately and land to building ratios vary between properties.

STEP NO. 5 LAND VALUATION:

The last step in the Cost Approach is the addition of land value. Land values are estimated by a land unit and stored for use in this step. Land valuation procedures are described in Section V.

The flow chart on the next page presents an overview of the procedural elements involved in the cost approach to value.

COST APPROACH PROCEDURAL FLOWCHART



II. E. ALTERNATIVE METHODS OF IMPLEMENTATION

Property may be mass assessed by various appraisal techniques. In the case of non-income generating real estate, the cost approach remains the most economical from the standpoint of data input, programming, debugging, and the production of reliable, equitable values on all types of properties.

There are, however, two methods which may be employed in implementing a cost approach. These are:

1. In-House Construction and Computerization of a Cost Manual.
2. Purchase of Pre-Established Computerized Cost Services.

All assumptions made to this point have been that such a cost manual exists. Since the purchase of such a manual involves a substantial initial and continuing investment, the steps required for the City of Boston to develop its own cost manual if it so chooses will now be discussed.

The primary difference between the two above methods is in the development of "Table Files". In mass appraisal terminology "Table Files" are those specific files in which market value indicators are stored and listed for reference and valuation purposes. Table Files may be developed for manual or automated operation. In-house construction of a cost manual requires an extensive market study for development of table files. Up-to-date cost factors, depreciation schedules and other valuation variables will have to be discovered in the local market. These value indicators must then be stratified by property type and stored in table files in a manner that will permit immediate retrieval as the steps to each approach are applied to all properties in mass. Purchase of pre-established cost services include table files that have been adjusted to the local market. Regardless of source, table files should be monitored on a periodic basis to ensure that they reflect up-to-date value indicators. Table files will be used extensively through all of the valuation modules.

1. <u>In-House Construction and Computerization of a Cost Manual</u>

The system design to implement the cost approach requires two files. One is the Master Parcel File (for residential and/or commercial properties) and the other is the Table File. Table files will, in this usage, store cost factors originating from the local market. Development of the MAF in Step 7 requires that the master parcel file be replaced by the Sales History File. The Table File contains all the rates, percentages, and/or lump sums needed in the Cost Approach. The specific use of the Table File will be explained in the step-by-step procedures for constructing both files.

RESIDENTIAL COSTING PROCEDURE

STEP 1. Base Value

The construction of a residential costing procedure is begun by categorizing the characteristics of the basic residential structure. This is accomplished with five data base elements:

Grade

Grade Adjustment

Condition

Architectural Design (type and style)

Story Height

Using this information, the system creates a structure code which is employed to access a record from the Table File. This record contains the base value costing equation for that structure code. This equation has the following format:

Base Value	=	(Perimeter x Perimeter Rate)
	+	(Square Footage x Square Foot Rate)
	+	(Whole Dollar Amount) x Percentage Adjustment

The perimeter rates, square foot rates, whole dollar amounts, and percentage adjustments are stored in the table file for each structure code. These rates and adjustments are considered the mathematical parameters for each equation. More specifically, these parameters are defined as follows:

PR = Perimeter Rate-$/lineal foot rate for vertical exterior wall calculations. A different rate is stored for each wall type.

SQR= Square Foot Rate-$/square foot rate for horizontal calculation. The square footage of ground area is used here.

C = Whole Dollar Amount - A constant dollar amount, which reflects a minimum cost for all structures, consequently reducing the adjustment process.

P = Percentage Adjustment - This adjustment factor is a number of the formula 1+P/100 - where P= percentage index. If P=0, no indexing takes place. This adjustment factor allows the value from the base rate equation to be factored for selected structure codes, such as split foyer, split level, etc.

If the basic residential structure contains additions or can be segmented into multiple sections, of varying story heights then the calculation of the base value is modified. The modification requires that the structure code for each section or addition be identified and the appropriate parameter found from the Table File. Then the base value for each section is calculated using the <u>total square footage of ground area for all sections</u> and <u>total perimeter</u> in each equation. The values obtained from these calculations are then divided by the total square footage to yield the square foot rates for each section. Next these square footage rates are applied to the square footage of each section to produce the cost of that section. The sum of these costs becomes the base value of the entire structure.

To illustrate this procedure, assume the following data were obtained from the Table File for the three structure codes describing three sections:

	PR	SQR	C	P
Main Structure	37.63	7.07	2020	15
Section 1	24.61	7.07	2020	15
Section 2	29.81	7.07	2020	15

If the main section has 1,000 square feet of ground area, section 1 has 400 square feet, and section 2 has 300 square feet, then a total of 1,700 square feet is used to form each equation. The perimeter for entire building is 210 feet. Then the three section base values produced are:

Main Structure Cost = (37.63x210)+(7.07x1700)+(2020)x(1.15)=$25,233.

Section 1 Cost = (24.61x210)+(7.07x1700)+(2020)x(1.15)=$22,088.

Section 2 Cost = (29.81x210)+(7.07x1700)+(2020)x(1.15)=$23,344.

Next, the unit square foot rates are calculated:

Main Structure Unit Rate = $25,233./1700 S.F.=14.84 $/S.F.

Section 1 Unit Rate = $22,088./1700 S.F.=12.99 $/S.F.

Section 2 Unit Rate = $23,344./1700 S.F.=13.73 $/S.F.

Finally, the overall base value for the entire building is computed by applying these unit rates to each section:

Cost Main Structure	= (14.84)x(1000)	= $14,840.
Cost Section 1	= (12.99)x(400)	= $ 5,196.
Cost Section 2	= (13.73)x(300)	= $ 4,119.
Total Base Value		$24,155.

If a grade adjustment exists on the data base record for the property being costed, then the calculated base value is factored by this adjustment percentage. Thus, in the example, if the property had a 10% grade adjustment (as determined by the field appraiser or data collector) then the recalculated base value would become (24,155)x(1.10) = $26,571.

To implement Step 1 in the system, the Table File records for each structure code need to be generated. In the residential costing procedure one structure code is created for each combination of grade, condition, style, type and story height. Based on the location and economic costs of construction materials and labor, square foot rates, perimeter rates as a function of wall type, and constant dollar amounts must be created for each structure code.

Building Base Value Implementation Notes

1. Base value equations are usually generated under an assumption that each residence has a basement or excavation. The base value must be adjusted for any structure lacking this characteristic. This adjustment for crawl space or slab is performed by a deduction from the calculated base value. This deduction is calculated using the equation previously described except the parameters are different. Perimeter rates as a function of wall type, square footage rates and whole dollar amounts are stored for this equation in each record of the Table File for each structural code.

2. When the perimeter of a residence is unknown or missing from the data base, the system may calculate its own estimated perimeter amount based on known square footage and prestored tables of square footage by perimeter.

3. To minimize the number of equations which must be generated, it is possible to determine the equations for every structure code associated with one grade, say the average grade. Then all other grade calculations are defined in relation to this standard grade. All base

value costs for other grades are then obtained as a factor in or indexing of, the standard grade value. For example, if the standard grade is taken to be "average quality", we might define the following:

Grade	Percent of Average Quality
Low Quality	25
Fair Quality	50
Average Quality	100
Good Quality	150
Very Good Quality	200

4. The perimeter rate must be defined as a function of the wall type. It may be possible to restrict the number of wall types to a basic set of three types, by defining all other types to be one of the basic three for costing purposes. For example, the following wall types by grade may be used:

Grade	Wall Type
Low Quality	1. Wood Siding
	2. Concrete Block
	3. Brick/Stone Veneer
Fair Quality	1. Wood Siding
	2. Concrete Block
	3. Brick Veneer
Average Quality	1. Wood Siding
	2. Concrete Block
	3. Brick Veneer, insulated

Good Quality	1. Wood Siding, insulated
	2. Brick Veneer, insulated
	3. Cut Stone Veneer
Very Good Quality	1. Wood Siding, insulated
	2. Brick Veneer, insulated
	3. Cut Stone, insulated

For other wall types, conversion to types 1, 2, or 3 would be defined: for Aluminum Siding use 1; for Part Brick facing in good and very good grades use 50% of 2, etc.

STEP 2. Adjustments to Base Value

The base value cost developed in Step 1 assumes that each residential grade possesses standard features such as plumbing, extra finished rooms, heating/air conditioning, fireplaces, built-in units, porches and garages. When the residence being costed diverges from the standard the base value must be adjusted by costing the individual differences and adding or subtracting them.

The following table illustrates by grade, examples of standard features that may be assumed:

Feature	Low	Fair	Average	Good	Very Good
Plumbing	1-3 fix bath	1-3 fix bath	1-3 fix bath	2-3 fix bath	3+fix bath
Attic Finished Rooms	none	none	none	none	none
Basement Finished Rooms	none	none	none	none	none
Heating A/C	no heater	no heater	forced hot air	hot water	hot water
Fireplaces	none	none	none	none	none
Garages	none	none	none	none	none
Porches	none	none	none	none	none
Built-Ins	none	none	none	none	none

Each feature of the residence being costed is checked against the standard feature assumptions. If it deviates from the standard, the table file is accessed to obtain unit cost data to calculate the amount of the adjustment. For example, the following rules might be employed for the list of features in the previous table.

(a) Plumbing. Adjust for each fixture above or below the standard fixture count for its grade. The unit fixture cost is obtained from the Table File.

(b) Attic Finished Rooms. If finished attic rooms exist, the data base would contain the percentage of total attic area containing the finished rooms. The total attic area is assumed to be some fixed percent (25%) of the square footage ground area of the section containing the attic. Then the Table File produces a percentage rate for costing finished attic rooms by grade. This percentage rate multiplied by the square footage of the finished attic rooms multiplied by the unit square foot cost for the section of the building containing the attic will yield the dollar adjustment to the base ground area.

For example, if the building with 1000 square feet of main structure contains an attic, and the table file produces 40% rate for finished attic rooms, and the Base Main Section Unit Rate is $14.84 then the cost is calculated as follows:

Total Attic Area	= 25% x 1000 sq.ft.
	= 250 sq.ft.
40% of the Total Attic Area	= 40% x 250 sq.ft.
	= 100 sq.ft.
Cost	= 100 sq.ft. x $14.84
	= $1484

If a grade adjustment was used in the base value calculation, then it must be applied in this computation. In this example, a 10% grade adjustment would produce a base adjustment of (1484)x(1.10)=$1632.

(c) Basement Finished Rooms. If finished basement rooms exist, then the data base contains the number of rooms and total square footage of finished area the basement. A square foot rate for finished basement rooms is obtained from the Table File as a function of the grade. The product of the rate and basement finished room area yields the base adjustment.

(d) Heating/Air Conditioning. An adjustment for non-standard heating and/or air conditioning is calculated as the product of the square footage of living area and a climate control square foot rate from the Table File. For some grades of residences, the calculated cost is deducted from the base value. This might be the case in average quality buildings with gravity-hot air heating systems, or in good or very good residences, with forced air or baseboard electric heating. Air conditioning cost adds to the base value in all grades.

(e) Fireplaces. Fireplace cost adjustments can be calculated as dollar amounts for different combinations of openings and chimneys. These lump sum amounts are stored in the Table File by grade.

(f) Garages. There are five types of residential garages: attached, detached, basement, built-in and carports. For each type garage the table file contains square foot rates as a function of square footage, construction type (framed, brick or stone) and grade. One rate is stored for selected square foot ranges such as less than 300 square feet, 300 to 600 square feet, and greater than 600 square feet. The adjustment cost is the product of the square foot rate and the square footage of garage area.

(g) Porches. Porch adjustment costs are calculated as the product of a square foot rate and the porch area. The square foot rates are stored in the Table File as a function of square footage, story height (1 or 2 story), and type (open or enclosed). As in garages, the square footage rates can be stored for selected groupings of square footages such as less than 25 square feet, 25 to 50 square feet, 50-80 square feet, 80 to 100 square feet, 100-150 square feet, 150-200 square feet, over 200 square feet. Porch rates can be stored independent of the grade or quality of the building.

(h) Built-ins. The Table File contains a lump sum dollar amount for each built-in by grade (e.g. kitchen equipment, etc.).

Adjustment Implementation Notes

1. It may be possible to cost each adjustment feature by taking a stored percentage of the base value cost. For example, plumbing adjustments may be defined for each grade as a percent (e.g. 1%) of the base value. Thus, if the base cost is $25,000, the cost for plumbing adjustment is (0.01) (25,000) or $250.

2. The system can be established to recognize lump sums for adjustments in place of the table value calculation.

STEP 3. Indexed Replacement Cost New (RCN)

To account for future changes in locational and economic construction and labor costs, and to adjust the base rate table values for these changes, a yearly index will be stored in the Table File. This index is used to factor the RCN cost and may be considered a time modifier. If the year the table base rates are constructed is 1979, then an index of 1.00 is assumed. If costs are inflating annually, then in 1985, the index used may be 1.566. To itemize the RCN calculation, each item in Step 1 and Step 2 are indexed before printing or storage.

STEP 4. Depreciation Calculation

Depreciation is calculated for three types: physical, functional and locational. These depreciation costs are subtracted from the indexed RCN obtained in Step 3.

Physical depreciation is calculated as percentage of RCN. This percentage yields the "percentage good" portion of RCN. To obtain the "percentage good" amount, the system locates a record from the Table File based on the condition code for the residence. This record contains a set of "percentage good" data for a stored set of effective ages. If the effective age of the property being costed is not in the stored set, the system interpolates to arrive at the percentage amount. For example, the Table File record may contain the following depreciation data:

	Effective Age									
Effective Age:	5	10	15	20	25	30	35	40	45	50
% Good:	95	85	80	60	50	45	40	40	30	20

This information shows that "percentage good", as a function of effective age, is not linear. Any depreciation curve defined in terms of percentage good and effective age can be quantified into discrete form for each condition and stored into a Table File Record. Based on depreciation data in the example above, an effective age of 18 years would produce a percentage good amount equal to:

$$80 + \frac{15-18}{20-15} \times (80-60) = 68\%$$

Then the indexed RCN from Step 3 is multiplied by the physical depreciation <u>percentage figure good (in this case 68%)</u> to yield a depreciated RCN value.

Functional and locational obsolescence costs are found in the same Table File which contains the depreciation curve data. These costs are stored as whole dollar or lump sum amounts. The obsolescence costs are subtracted from the depreciated RCN value to yield the final depreciated, adjusted, and indexed Replacement Cost New.

<u>STEP 5. Other Improvements</u>

Other improvements not associated with the primary structure but which contribute to value are costed in this step. These include swimming pools, tennis courts, concrete driveways, landscaping, and other separate buildings.

Items of this type are costed by finding a rate ($/SF) in the Table File as a function of type and grade of the improvement and multiplying this rate by square footage of the improvement.

The cost of all items of this type need to be depreciated if found from a rate. Depreciation schedules must be stored in table files for other improvements such as detached garages. Miscellaneous improvements such as paving, fencing and out-buildings can be costed by a depreciated unit price, utilizing appraisers judgement. Other improvements will require a yearly index to account for yearly increases in construction cost. This index may be referred to as a time modifier.

STEP 6. Replacement Cost New Less Depreciation (RCNLD)

The depreciated indexed RCN after Step 4 added to the sum of all depreciated Other Improvements in Step 5 yields the Replacement Cost New Less Depreciation value of all buildings and improvements.

STEP 7. Conversion of Cost Value to Market Value

The RCNLD value obtained from Step 6 may not reflect current market value. This is due to the value influencing effect of location. As has been pointed out, the Cost Approach treats property types with similar physical characteristics in a similar fashion. However, there exists a need to adjust this cost value for the effects economic, political and social forces have on value at the neighborhood level. This adjustment process is done by indexing RCNLD by a "Market Adjustment Factor" (MAF).

The MAF is calculated by taking the sales price for which a property has sold in an arms length transaction and subtracting land value. The remaining value is the market indication of value allocated to depreciated improvements which when divided by RCNLD will produce the MAF. For processing purposes, the system will utilize the aggregate sales prices less the aggregate land values divided by the aggregate RCNLD for all samples in the study. The resulting quotient (MAF) is then used to factor the RCNLD on all properties in the neighborhood.

STEP 8. Land Value

The next step is the addition of land value to the market adjusted RCNLD. Land values are estimated by a land unit and stored for use in this Step. Land valuation procedures are described in Section V.

STEP 9. Estimated Market Value

The sum of the market adjusted RCNLD and land value after Step 8 yields an estimated market value of the property.

Data Requirements Summary

Step	Data Base	Table File
1 - Base Value	Grade	Perimeter-rates by Wall Type
	Condition	Square Foot Rate
	Construction Type	Whole Dollar Amount
	Style	Percentage Adjustment
	Story Height	Time Index Factor
	Grade Percentage	
	Wall Type	
	Square Footage Living Area	
	Perimeter	
2 - Adjustments	Plumbing	
	No. Fixtures	Unit Fixture Cost
	Attic Finished Rooms	
	Attic Area %	Percentage by Grade
	Basement Finished Rooms	
	No. Rooms/Area	Square Foot Rate by Grade
	Heating/Air Conditioning	Square Foot by Grade
	Fireplaces	
	No. Openings	Whole Dollar Amounts by Grade
	No. Chimneys	
	Garages	
	Garage Type	Square Foot Rates by grade each
	Garage Area	type
	Construction Type	

	Porches	
	Porch Area	Square Foot Rate by Grade for
	Story Height	each height and type
	Type	
	Built-Ins	
	Stoves	Whole Dollar amounts by type
	Refrigerator	
	Dishwasher	
	Disposal	
	Fan/Hood	
	Compactor	
	Etc.	
3 - Indexed RCN		Time Index Factor
4 - Depreciation	Physical	
	Effective Age	Percentage good by effective ag
	Condition	for each condition
	Functional/Locational	Whole Dollar Amounts
	Obsolescence	
5 - Other	Pools	
Improvements	Area	Square Foot Rates by Type/Quali
	Type	
	Quality	
	Depreciation %	
7 - Market Adjust-	Neighborhood No.	Adjustment Factor for location
ment Factor		by neighborhood
8 - Land Values	Land Area	Square Foot Rate by Location

COMMERCIAL STEP-BY-STEP COSTING PROCEDURE

STEP 1 Base Value

The commercial costing procedure begins by identifying the components which categorize commercial properties. These are:

Occupancy Code (Use)

Construction Classification Type

Story Height

Using this information, the system creates a commercial structure code. The table file can be accessed to find the base value equation with the parameters:

TA = Total Floor Area Rate = $/Square Foot Rate

PR = Perimeter Rate = $/foot rate stored as a function or exterior wall type.

C = Whole Dollar Amount - A constant dollar amount

P = Percentage Adjustment - Adjustment Factor

The base value equation becomes:

$$\text{Base Value} = (\text{Perimeter} \times \text{PR} + \text{Total Floor Area} \times \text{TA} + \text{C})\ (1 + \frac{\text{P}}{100})$$

To implement Step 1, the Table File Records for each equation need to be generated. This means that for each combination of occupancy code, type and story height, the perimeter rate for each wall type, total floor rate, and constant dollar amount must be developed and stored in the Table File.

Also stored in the Table File are adjustment percentages for deviations from the standard base value equation identifiers. For example, a story height not included for some equations can be used by a percentage adjustment of the base value for a similar structure.

STEP 2 Adjustments to Base Value

The base value in Step 1 must be adjusted for specific features which may exist. The costing of these features is performed using the Table File. Examples of items to be used for adjusting the base value are listed below:

a. Heating, Cooling and Ventilation. A square foot rate by type is obtained from the Table File and is multiplied by the total area to yield cost.

b. Elevators. This item can be costed by obtaining whole dollar costs by type from the Table File.

c. Sprinklers. Same Approach as in b.

d. Built-ins. Same approach as in b.

e. Garages. Same as in a. or b. except that rates are found as a function of type (attached, detached, basement, or built-in).

f. Porches. Same as e.

g. Vaults. Same approach as in a.

h. Stages and Permanent Fixtures. Same as in a.

i. Mezzanines. Same approach as in a.

j. Balconies. Same approach as in a.

k. Docks. Same approach as in a.

STEP 3. Indexed Replacement Cost New

The items in Step 2 and the base value in Step 1 must be indexed to account for time changes to costing parameters in construction material and labor. This time index is stored in the Table File.

STEP 4 Depreciation Calculation

Depreciation cost is calculated for three types: Physical, functional and locational. These costs are applied to the indexed RCN of Step 3.

The Table File contains depreciation "percentage good" data as a function of effective age. These data relationships are stored for different condition types. Thus, given the condition and effective age, the percentage good amount is obtained from the Table File and applied to the indexed RCN to account for physical depreciation. The costs for functional and locational depreciation are converted to whole dollar amounts which are stored in the Table File. These costs are subtracted from the depreciated indexed RCN amount.

STEP 5 Other Improvements

Any improvements not included in the primary structure cost is added at this step. These items can be costed by using a depreciated lump sum amount or a square foot rate from the Table File. These costs need to be time indexed - see Step 3.

STEP 6 Replacement Cost Less Normal Depreciation

The sum of all other improvements in Step 5 and the depreciated value from Step 4 form the Replacement Cost Less Normal Depreciation.

STEP 7 Conversion of RCNLD to Market Value

Provided that sales are available, a market adjustment factor (MAF) can be calculated as described in Step 7 for residential costing. If sales are not available, individual or field appraisals can be substituted for sales data.

STEP 8 Land Value

Land Value can be calculated from square foot rates stored in the Table File by location code, or by site value stored by location code.

STEP 9 Estimated Market Value

The product of MAF and RCNLD, plus Land Value in Step 8 becomes the estimated market value.

II. E. Alternative Methods of Implementation

2. Utilization of Established Computerized Cost Services

There are a number of nationally known companies which produce Cost Services for valuation purposes.

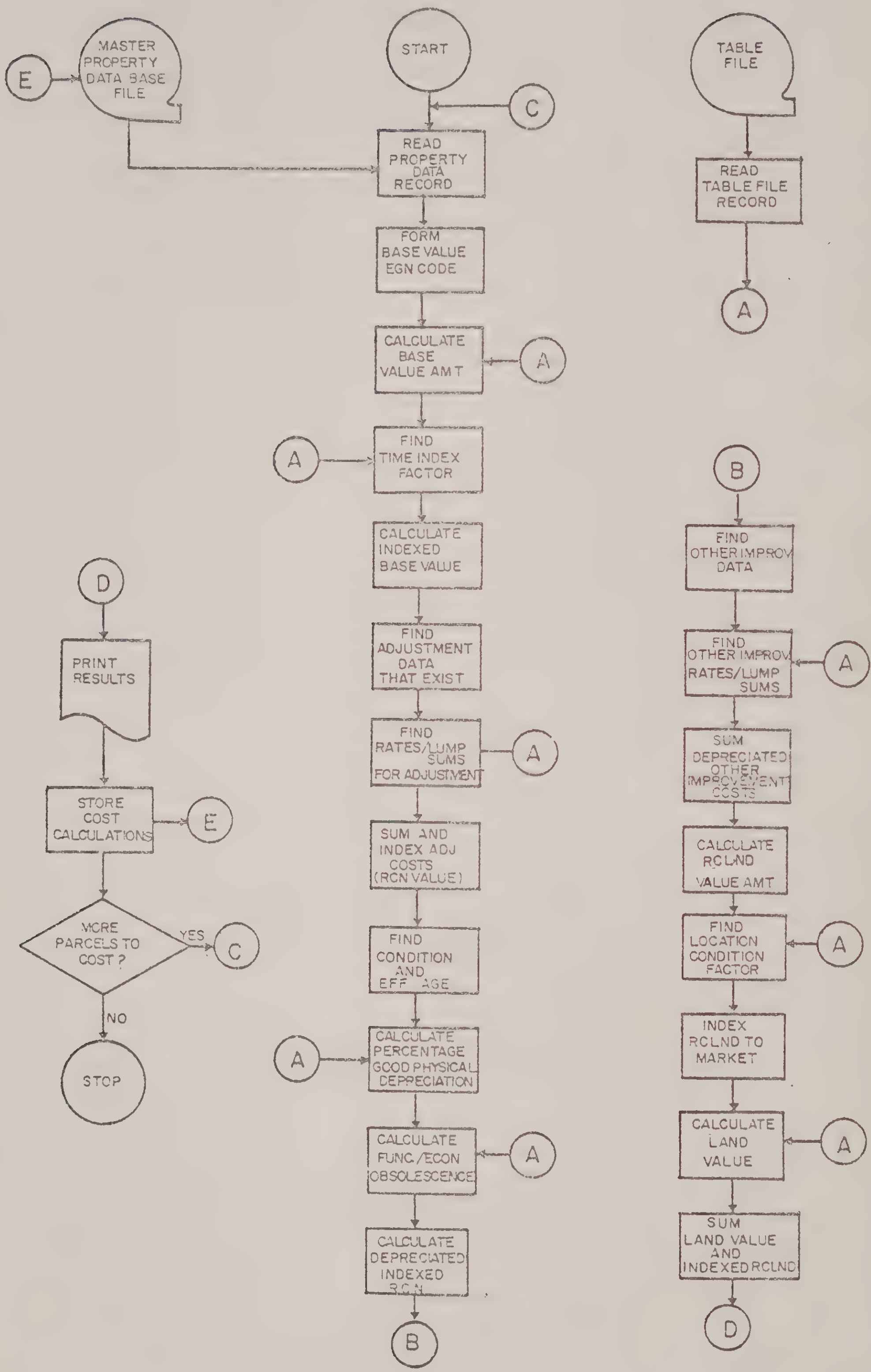
The process in this instance is the same as in an "in-house" cost system. The primary advantage to an established system is that it is working, therefore, development and implementation problems will be minimized.

The time frame for implementation with an established service would be considerably less than with an in-house system. This is because the parameters and equations are already compiled, along with some of the appropriate software. Maintenance of this type of system is done by the cost service, thereby reducing manpower.

The actual procedure process of valuation with this method would be the same as presented earlier.

Start:	Replacement Cost New
Less:	Accrued Depreciation
Equals:	Replacement Cost New Less Depreciation
Times:	Market Adjustment Factor
Plus:	Land Value
Equals:	MARKET VALUE-COST APPROACH

COST MODULE FLOW CHART



III. THE INCOME APPROACH

A. General Overview of Income Approach and Valuation Procedures

When reliable and relevant market information (comparable sales) is available, it should be given primary consideration in the valuation of any type of property. However, market information does not always take the form of a sales transaction. For example, market construction costs are used in the application of the Cost Approach to value. Likewise, market rent is often an accurate indicator of the value of income producing properties. The logic behind the use of rental income in valuation is that property is bought and sold with its sales price dependent on the amount of income produced. Therefore, there is a calculable relationship between income and value.

The basic procedure used in the Income Approach is that of capitalizing the Net Rental Income or Net Income attributable to the property into an estimate of value. This may be illustrated by an example from everyday finance: a bank account earns $500 per year at 5% interest. To determine the amount of principle balance in the bank, the income may be capitalized by dividing the interest rate into the interest income. Five hundred dollars divided by .05 equals $10,000. The income of $500 was capitalized into a value of $10,000. Likewise, if one put $10,000 into the bank and received 5% interest, he would receive $500 per annum as long as the principle balance remained $10,000. This basic theory applies to real estate with the exception that the rate involves more than interest or discount.

It is recognized that variables in the investment, (e.g. mortgage interest, equity build-up, appreciation, etc.) will have a direct effect on the capitalization rate and will be discussed accordingly under capitalization rates.

In applying the Income Approach in mass appraisal, appropriate properties must be identified and stratified. This is accomplished through a classification and grading system. Property types which may be valued by the Income Approach include apartments, offices, shopping centers, garages, retail and commercial rental stores, industrial properties (primarily warehouses), motels, and some residential properties.

For each of these types, six steps will be performed by the system. The steps, followed by a detailed explanation of each item and its delineation, are:

Step No. 1: Gross Income
Step No. 2: Vacancy and Credit Loss
Step No. 3: Effective Gross Income
Step No. 4: Expenses
Step No. 5: Net Income
Step No. 6: Capitalization of Income

Step No. 1: Gross Income

Gross Income is "the scheduled income from the operation of the business or management of the property, customarily stated on an annual basis". In the appraisal of real estate, "scheduled income" refers to rental income and miscellaneous income which should be generated by the property itself, not by the business occupying that property. Scheduled Income is often referred to as "potential" gross income, (ie. that income which would be produced under typical management with a 100% occupancy rate). Gross Income Data will be located within the data system in table files stored by property type or occupancy code.

The table files will store data per unit of economic (market) rent, such as office space per square foot (Net Leasable Area); retail space per square foot (Gross Leasable Area); apartment space per unit or square foot; motel space per average daily rental. Table files will also store "miscellaneous income" such as income derived from parking, vending machines, etc. This miscellaneous income will be filed as a percentage of gross income for each respective occupancy code.

The table files will be checked and updated using published income and expense data such as <u>The Dollars and Cents of Shopping Centers</u> (Urban Land Institute) and <u>Income and Expense Analysis for Apartments, Condominiums and Cooperatives</u> (Institute of Real Estate Management). The validity of these sources may be checked periodically by utilizing income and expense questionnaires sent to all owners of commercial properties. The combined result of all of this input data will be an accurate table file for gross income which will provide reliable estimates for any given income producing property in Boston. An override feature will be available for the appraisers if there are instances when the table file is not accurate. All overrides should be approved by the supervisor before valuations are considered final.

<u>Step No. 2: Vacancy and Credit Loss</u>

The allowance for vacancy and income loss has been defined as, "that amount deducted from potential annual gross income to reflect the effect of probable vacancy and turnover, or non-payment of rents by tenants; commonly expressed as a percentage of potential annual gross income and then converted to a dollar figure; the percentage of vacancy and income loss is the complement of the occupancy ratio".

Vacancy and credit loss therefore provides the system opportunity to make an allowance for whatever typical vacancies exist for particular property types and also to allow for a proportion of loss due to credit risks or non-payment of rentals. The system will store typical loss-percentages of gross income for the various occupancy types. Override capabilities will be available for the individual appraiser in the instance a property does not, for some reason, conform to the typical situation.

Step No. 3: Effective Gross Income

Effective gross income is derived by subtracting vacancy and credit loss from potential gross income. This is a mathematical computation and will be performed internally by the system.

Step No. 4: Expenses

Operating Expenses are defined as, "...all expenses necessary to maintain the production of income from operation of a property; the difference between effective gross income and net operating income. Also used to denote a category of expense exclusive of fixed expense, debt service, depreciation and reserves for replacements".

Expense items are stored in Table Files by expense type and property type. There are fourteen expense items within four general topic areas. These are as follows:

1. Maintenance and Operating Expenses

   a) Total Payroll Expense
   b) Supplies
   c) Painting/Decorating
   d) Maintenance/Repair
   e) Service
   f) Miscellaneous Operating Expenses

2. Utility Expenses

   a) Electricity
   b) Water
   c) Gas
   d) Heating Fuel

3. Administrative Expenses

   a) Management Fees
   b) Other Administrative Costs

4. Taxes and Insurance

   a) Insurance
   b) Non-Real Estate Taxes

These expenses will be stored as a percentage of potential gross income by property types. The percentages will be for each of these expense items and also for the total of each of the four topic areas of expenses. The system will then have the capability of calculating expenses on any generated gross income with or without an owner's operating statement.

The system will automatically calculate the expenses allotted for that occupancy code from the stored expense item percentages. If there is an owner's operating statement, the system will also display the actual input expenses (conforming to the expense categories above) for comparisons. In addition, the system will allow the appraiser to manually override the total expenses or any of the four subtotal areas. Override capabilities would only be utilized in those cases where unusual circumstances dictate that the allowances stored in the table file are not applicable.

A brief description of each of the expenses is provided below:

1. Total Payroll Expenses: Payroll expense refers to the salaries of those persons working in the management or maintenance of the property involved. These salaries are "property related", not "business related". The salary of a clerk in a pharmacy store would not be a payroll expense as it is business related. The salaries of the cleaning and maintenance crews which clean the shopping center which contains the pharmacy are legitimate "payroll expenses".

2. Supplies: Supplies refer to any material which is used in the continued operation of the building. Most common items will be material supplies for purposes of maintenance. Office supplies would only be allowable to the extent that they are used in maintenance of the physical structure.

3. Painting and Decorating Expense: Painting expense refers to the cost involved in painting unoccupied units. Periodic exterior painting should be prorated so that only the portion pro-rated for one year would be reflected in any given year. Decorating only refers to that amount of decorating which is done each year and which is directly related to maintaining the rental income to the property.

4. Maintenance and Repair: These items should reflect only those costs related to the maintenance of the property. They might include repairs to the roof (not re-roofing) and all other maintenance oriented expense incurred on an annual basis.

5. Service Expenses: Service expenses include those costs from pest control services, garbage disposal, lawn care, etc., which are anticipated to occur on an annual basis. Any expense item should be directly related to the continued flow of income to the property.

6. Miscellaneous Operating Expense: This allows for any unusual operating expenses which may not fit into one of the five categories above but is necessary for continual operation of a particular property. This should reflect only anticipated annual expenses, not any "one-time" or periodic costs.

7. Electricity: This represents the anticipated annual cost of electricity to the property for a twelve month period. Costs will be built into the table file and may be updated with owner verification.

8. Water: This item represents all annual charges for water usage to the property. As with all expense items, the typical usage for each occupancy code will be used with availability for override with proper documentation.

9. Gas: The annual typical dollar allowance for gas (if applicable) to the individual occupancy code will be computed by the system.

10. Heating Fuel: Represents the typical annual fuel cost for the various occupancy codes.

11. Management Fees: Management fees usually range from 6-9 percent of effective gross income. The typical percentage utilized by property managers in the Boston area will be applied automatically by the system. There should be a notation to indicate if a property does not have a "property manager" to see that the system will not allow double accounting under payroll and under this item. Management fees are to be stated as an annual expense to the property.

12. Other Administrative Costs: These include any annual administration costs which might not come under the heading of management fees.

13. Insurance: This item covers only those annual expenses incurred in insuring the property against fire, theft and actions of the elements. Personal life insurance would not be permissable as this is a business expense, not a property expense. Care should be taken to determine that costs provided represent only annual charges since many commercial policies are for three to five years.

14. Other Non-Real Estate and Income Tax Expenses: This excludes all personal and corporate real estate and income tax expenses. Allowances for real estate taxes will be built into the capitalization rate. Income taxes are tailored to the individual's income and may vary between two individual owners.

Step No. 5: Net Income Determination

Net Income is derived by subtracting the total expenses from effective gross income. Net income is sometimes referred to as "Net Operating Income" (NOI) and is defined as "annual net income remaining after deducting all fixed and operating expenses but before deducting financial charges such as recapture or debt service; it is sometimes referred to as Net Income Before Recapture (NIBR) or Net Income Before Depreciation (NIBD)".

This calculation will be automatically performed by the system, and the resulting annual net income will be printed as a dollar amount and percentage of Gross Income. The percentage amount for net income and for expenses will serve as an aid for quick checking of the results of the income of similar properties.

Step No. 6: Capitalization of Income

Capitalization is defined as, "the process of converting into present value (or obtaining the present worth of) a series of anticipated future periodic installments of net income. In real estate appraising, it usually takes the form of discounting".

The net income derived in Step No. 5 is assumed to be that income which will accrue from the property on an annual basis over a predictable period of time. This income is converted into value by dividing it by a Capitalization Rate appropriate for that particular property type. For example, an anticipated net income of $120,000 may be capitalized into a value with a capitalization rate of 10 percent (.10). The value is derived by dividing the $120,000 by the 10%.

$$\frac{\$120{,}000}{.10} \quad = \quad \$1{,}200{,}000$$

Various methods which might be utilized in rate determination are the Band of Investments Method; the Mortgage Equity - Ellwood Method (Ellwood Tables-American Institute of Real Estate Appraisers); the Instant Mortgage Equity Method (Ira Johnson-Health Lexington Books); and the Market Method (strict utilization of available market data).

An income and expense format will be produced by the system on every property where an income approach valuation is applied and may be viewed on the next page.

INCOME APPROACH FORMAT

Table Files

Gross Income:
(1) Stored by type and grade
(2) Unit economic rent, e.g. office/ft^2 (Net Leasable area); Retail/ft^2 (Gross Leasable Area); Apartments/Unit or ft^2/ Motel/ADR
(3) Miscellaneous Income (% of Gross Income as per Class)

Vacancy and Credit: Percent of Gross Income as a function of type, grade, and location

	Stored Table*		Actual** statement with edit Criteria	(Appraiser' Override)***
Expenses:	Total Payroll Expense	%/G.I.		
	Supplies	%/G.I.		
	Painting/Decorating	%/G.I.		
	Maintenance/Repair	%/G.I.		
	Service	%/G.I.		
	Miscellaneous Operating Expenses	%/G.I.		
	*Sub-Total Maintenance and Operating	______	______	______
	Electricity	%/G.I.		
	Water	%/G.I.		
	Gas	%/G.I.		
	Heating Fuel	%/G.I.		
	*Sub-Total Utilities	______	______	______
	Management Fees	%/G.I.		
	Other Administrative Cost	%/G.I.		
	*Sub-Total Administrative	______	______	______
	Insurance	%/G.I.		
	Other Non-Real Estate and Income Taxes	%/G.I.		
	*Sub-Total Taxes and Insurance	______	______	______
TOTAL ALL EXPENSE		______	______	______

NET INCOME: Gross Income Minus Vacancy and Credit and Expense from the Three Indicated Sources * - ** - ***.

$ ________________ ______%

Capitalization Rate ________________%

Indicated Value ________________

B. Specific Tasks for Implementation

1. Stratification of Income Producing Properties

a. Income producing properties will have to be stratified according to specific property types, subgrade and by neighborhood. The subtypes which will be valued with the income approach are:

SUB-TYPES	GRADE	NEIGHBORHOOD
Apartments	A	N_1-N_n
Hotels	B	
Motels	C	
Office Buildings	D	
Parking Lots		
Retail Stores		
Shopping Centers		
Warehouses		
etc.		

2. Development of "Table Files"

"Table Files" are designated storage areas within the automated system. These table files contain data pertaining to a specific portion of the valuation system and are used when those specific data are needed for valuation or analytical purposes. There are three table files from which data will be drawn for use in the Income Model.

INCOME TABLE FILES

a. Gross Income Table File

b. Expense Table File

c. Rate Table File

Each of the above table files will be initially established from reliable "source" documents and/or from actual market data. Sources will include published trade journals, property ownership questionaires/forms and data obtained from financial institutions. Each table file will be discussed below concerning potential sources, manipulation and storage of data.

a. Gross Income Table File

1. Source of Income Data: Gross income data may be obtained from several sources. The first is published material, some of which are presented below for the respective property sub-types.

TYPES	SOURCES
Apartments	1. Income and Expense Analysis: Apartments Condominiums and Cooperative (the Institute of Real Estate Management)
	2. Property Ownership Survey Forms (Profit and loss statements)
	3. Audit checks, in office and/or field to verify the accuracy of both reports and questionnaires.

TYPES	
Office Buildings	1. Journal of Real Estate Management (Institute of Real Estate Management)

TYPES	SOURCES
	2. Property Ownership Survey Forms (Profit and Loss statements)
	3. Audit checks, in office and/or field to verify the accuracy of reports and questionnaires.
Hotels	1. Property Ownership Survey Forms (Profit and Loss statements)
	2. Audit checks, in office and/or field, to verify the accuracy of reports and questionnaires
	3. Published national
Parking Lots	1. Property Ownership Survey Forms (Profit and Loss statements)
	2. Audit checks, in office and/or field to verify the accuracy of reports and questionnaires
Retail Stores	1. Leases
	2. Property Ownership Survey Forms (profit and loss statements)

TYPES	SOURCES
	3. Audit checks, in office and/or field to verify the accuracy of reports and questionnaires
	4. Dollars and Cents of Shopping Centers (Urban Land Institute)
Shopping Centers	1. Dollars and Cents of Shopping Centers (The Urban Land Institute)
	2. Leases
	3. Property Ownership Survey Forms (profit and loss statements)
	4. Audit checks, in office and/or field to verify the accuracy of reports and questionnaires.

2. Storage of Data Once the gross income data has been gathered, it is to be stored by the stratifications shown below, property sub-type, classification and neighborhood.

PROPERTY TYPE	PROPERTY SUB TYPE	GRADE	NEIGHBORHOOD
Commercial	Apartments (4 units)	A	N_1 to N_n
	Hotels	B	
	Motels	C	
	Office Buildings	D	
	Parking Structures		
	Retail Stores		
	Shopping Centers		
	Warehouses		
	etc.		

Once income properties have been stratified and Gross Income for each type has been identified it will be necessary to store the gross income estimates in a table file by some unit value. The unit value becomes a common denominator that when multiplied by the stored number of units for each property on the Master Parcel File, a gross income estimate for each property is produced. Examples of unit types that may be used for storing income estimates are as follows:

TYPE	VALUE UNITS
1. Apartments	a. Rent per Unit
	b. Rent per Square Foot of Leasable area
	c. Other Income, Laundry, Vending as percent of G.I.
	d. Other Income, Pool, Tennis, etc. as a percent of G.I.
2. Hotels	a. Rent per Room
	b. Gross Leasable Area
	c. Net Leasable Area
	d. Other Income-Vending, Etc. as a percent of G.I.
	e. Other Income-Restaurant, Bar as a percent of G.I.
3. Motels	a. Rent per Room
	b. Gross Leasable Area

TYPE	VALUE UNITS
	c. Net Leasable Area
	d. Other Income-Vending, Etc. as a percent of G.I.
	e. Other Income-Restaurant, Bar as a percent of G.I.
4. Office Buildings	a. Gross Leasable Area
	b. Net Leasable Area
	c. Other Income, as a percent of G.I.
5. Parking Structure	a. Rent per Space
6. Retail Stores	a. Square feet of Gross Leasable Area
	b. Square feet per Net Leasable Area
	c. Other Income as a percent of G.I.
7. Shopping Centers	a. Square feet of Gross Leasable Area by tenant type
	b. Square feet of Net Leasable Area by tenant type
	c. Rent per Tenant for Common Area Charges
	d. Other Income, as a percent of G.I.
8. Warehouses	a. Square feet of Gross Leasable Area
	b. Square Feet of Net Leasable Area

b. Expense Table File

1. Source of Expense Data: Expense data may be obtained from the same sources listed above for gross income data. These include:

1. Income and Expense Analysis: Apartments Condominiums and Cooperatives (the Institute of Real Estate Management)

2. B.O.M.A. (Building Owners and Managers Association)

3. Journal of Real Estate Management (the Institute of Real Estate Management)

4. Dollars and Cents of Shopping Centers (The Urban Life Center)

5. Actual Leases

6. Property Ownership Survey Forms/Questionnaires

7. Audit checks for verification of published reports and ownership surveys.

2. Storage of Data: As in the Gross Income Table File, data must first be stratified in the manner above by Property Type, Property Sub-type, Grade and Neighborhood. The specific expenses which will be stored for all of the sub-types of properties are as follows:

EXPENSE ITEMS (Annually)

Vacancies (as a percentage of gross Potential Income)
Collection Losses (as a percentage of Gross Potential Income)
Payroll Expenses
Supplies
Painting/Decorating
Maintenance/Repair
Service Expenses
Electricity
Water
Gas

EXPENSE ITEMS (Annually)

Heat Fuel
Management Fees
Other Administrative Costs
Insurance Fees (Annual)
Non Real Estate, Non Income Oriented Taxes

c. Capitalization Rate Table File

1. Sources of Rates: The capitalization rate is defined as "any rate, such as an OVERALL RATE, used to convert an estimation of income to an estimate of market value. It is the ratio of normal net income to market value." Rates to be used in the system will be estimated by a unit and stored in a table file according to specific property types, sub-types, grade and by neighborhood. The rate selection unit should utilize all sources of information in the process of rate estimation. Sources of information should include but not be limited to the following:

(1) Actual Market Sales

(2) Real Estate Appraisers

(3) Real Estate Brokers

(4) Major lenders (large banks, Life Insurance Companies, etc.)

2. Delineation of the Capitalization Rate: The capitalization rate by definition is the ratio of net income to market value expressed as a percentage. For assessment purposes, due to the fact that taxes are not known and cannot be deducted as an expense item, the effective tax rate must be added to the capitalization rate. The effect tax rate is the ratio of taxes to Market Value expressed as a percentage. Consequently, the capitalization

rate for assessment purpose would consist of the following:

Discount Rate: Return on investment

Capital Recapture Rate: Return of investment

Effective Tax Rate: Requirement for Taxes.

3. <u>Selection of the Capitalization Rate</u>:

There exist several acceptable methods of selecting a capitalization rate. The purpose of this manual is not to dictate the method to be used in the selection process. However, it should be pointed out that the capitalization rate should reflect actions of the investor or typical purchaser for income producing properties as is being demonstrated in actual market transactions. For example, the discount rate used in valuing real estate cannot be equated to interest on cash deposits, as the investors return on real estate may be directly affected by mortgage financing, property appreciation or depreciation and other investment variables. Demands for recapture requirements may be affected in the same manner. On the contrary, the effective tax rate is a constant part of the total capitalization rate and will be the same on all properties in the jurisdiction.

The rate selection unit should be trained in investment analysis and familiar with capitalization rates and methods of selection. They should utilize all available sources of information and monitor this information by analyzing arms length market transactions. Because of the capitalization method utilized in the valuation model, the capitalization rate selected must be in the form of an overall rate. The overall rate must contain within the rate, an allowance for discount, capital recapture and Real Estate Taxes.

4. Storage of Capitalization Rates: Rates will be stored in a table file by property type, sub-type, grade and by neighborhood. The table file will be accessed by the computer during the valuation step. Table files should be updated annually.

d. Capitalization Method by Income Model

The method of converting net income into an indication of value will be by direct capitalization utilizing an overall rate. This method involves a single step of dividing net income by the appropriate capitalization rate (Net Income ÷ rate = Value) and will produce a single value for the property including land and improvements. The capitalization rate used should be estimated by the use of actual market transactions or by taking into consideration all investment variables involved in the ownership of income producing properties. Specific variables implied are:

(1) Percent of Debt-loan to Value Ratio

(2) Percent of Equity

(3) Mortgage Interest Rate

(4) Equity Yield Rate

(5) Effective Tax Rate

3. Specific Tasks for Implementation

The Maintenance of the Income Model may be viewed in six steps. These are broadly stated because the specific actions have already been presented above.

a. Update From Sales

The system will retrieve all commercial sales and, using the net income resulting from table files, generate a "market overall rate".

Net income (from profit and loss statement) ÷ Sales Price (from sales file) = OAR (overall rate)

b. Update Rate Table File

The rate table file will be updated with the market OAR's from the step above and also from any changes in mortgage interest rates, equity yields or other financial considerations.

c. Update Gross Income Table File

The gross income table file will be updated from actual profit and loss statements per property sub-type, grade and neighborhood strata level to determine the "typical" gross income for each property ("market or economic" rent).

d. Update Expense File

The expense table file will be updated from actual profit and loss statements gathered from property ownership questionnaires. These are combined in the same manner as the Gross Income described above to arrive at typical expenses for each of four categories:

Vacancies and Collection Losses (% of G.I.)

Maintenance and Operating (% of G.I.)

Administrative (% of G.I.)

Taxes and Insurance (% of G.I.)

e. Calculation of Net Income and Property Value

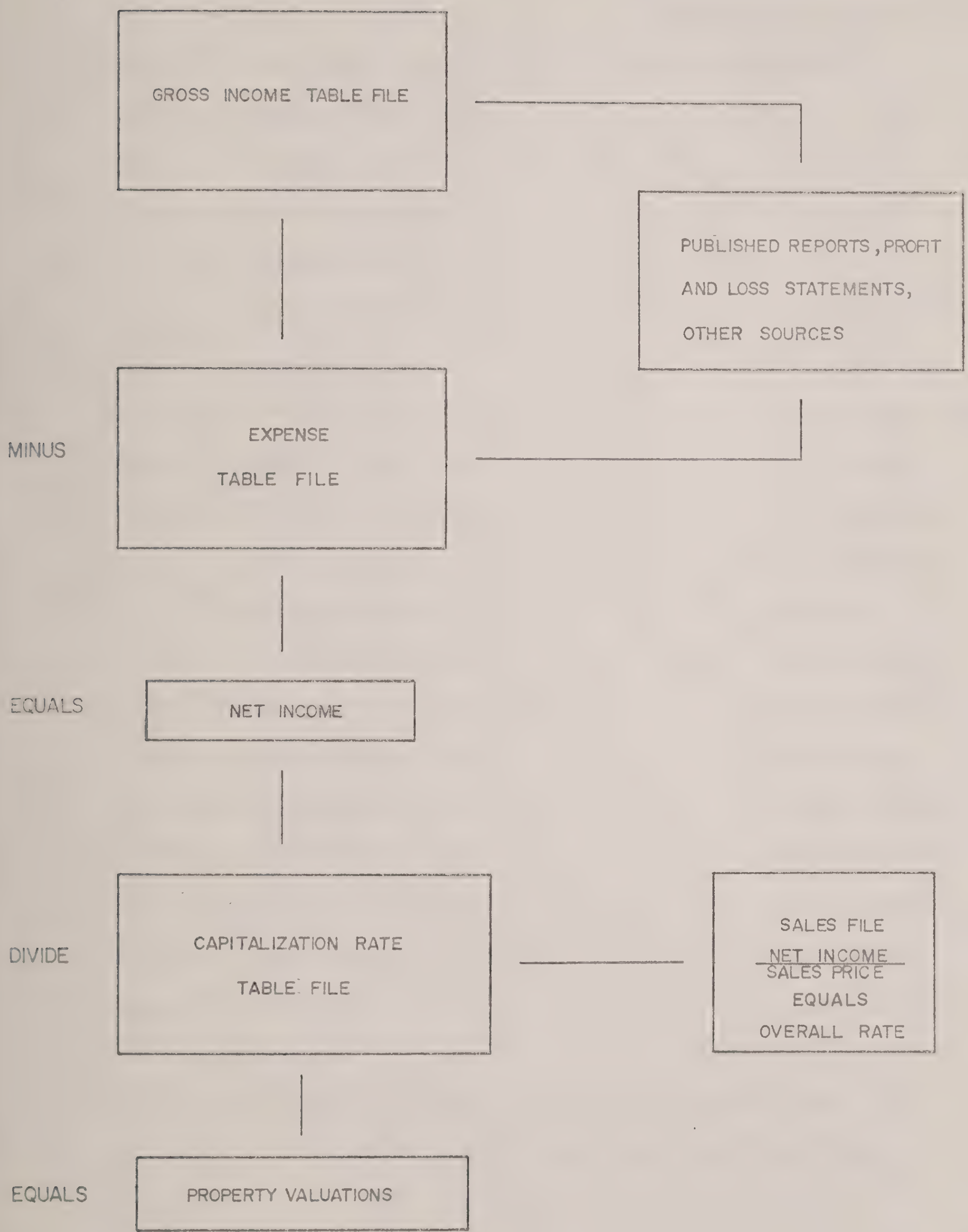
The determination of net income and the subsequent calculation of the property value is mechanically accomplished. An additional feature of this component, of the system will be to interface with the Cost Model and Land Model to double check all values produced. The value calculation and checks will be accomplished as follows:

Net Income ÷ Overall rate = Value

Value-RCNLD = Land (RCNLD from Cost Model)

Value-Land = Improvements (Land Value from Land Model)

INCOME APPROACH PROCEDURAL FLOWCHART



IV. Market Approach to Value

A. General Overview

The Market Approach to value is based on the supposition that a buyer would pay no more for one property than he would for another like property which provides similar utility. The Market Approach relies upon the use of sales of properties that are comparable or similar to each other. Once these sales have been gathered and verified as arms length sales, they are analyzed in order to determine the amount of the "Market Contribution" of each component of the real estate. Once the market value of these components has been determined, the values may then be used in comparing properties which have been sold against properties which have not been sold. The following example illustrates the Market Approach:

A property was sold for $40,000, and another property was sold for $43,500. Further analysis of these two properties indicates that they are located in similar neighborhoods and that the distance to residential amenities (i.e., shopping centers, schools, churches, etc.) is the same. Both of these properties were financed through the Veteran's Administration, and both sales were consumated at approximately the same time. In viewing the physical characteristics of the two properties, it is discovered that both properties are virtually identical with one exception, the property which sold for $40,00 has no car storage facilities whereas the house which sold for $43,500 has a one car detached garage. Since it has already been established that these houses are virtually identical in terms of time of sale, location, amenities, and financing, and that the only major difference in physical characteristics is the detached garage, it may be safely assumed that the difference between the two sales prices is the Market Contribution of the detached garage. Once the Market Contribution of this particular component has been identified, the value of that component may be used when comparing similar properties elsewhere within the taxing jurisdiction which have not sold. The Market Approach continues this process of comparing and analyzing properties which have sold to obtain value contributions to apply to properties which have not sold until all of the physical characteristics of a property have been adequately described and the market contribution of each in the current real estate market has been identified. The process requires a large number of sales of comparable properties. If the Market Approach is applied with only a few sales the reliability of a market estimate will be questionable, since there is a direct correlation between the number of bona fide and verified sales and the reliability of the market estimate. An understanding of and an appreciation for the process involved in analyzing sales for the purposes of determining market contributions is necessary in order to utilize the market approach.

The Market Approach utilizes one of four general methodologies:

1. Market-Oriented Cost Approach
2. Multiple Regression Analysis (MRA)
3. Gross Income Multipliers (GIM)
4. Manual Field Review

1. Market-Oriented Cost Approach

Traditionally, mass appraisal systems have been geared to the Cost Approach to value. The input of market sales information into the system is applied within the Cost Approach to create a "Market Oriented" cost system as explained in Section II. of this Chapter. Cost information is easier to apply to properties in mass, both from the standpoint of handling data and from the standpoint of understandability by the public. Combining this cost information with the additional accuracy gained from the utilization of market data produces value estimates which maximize both data processing time (whether automated or manual) and reliability.

2. Multiple Regression Analysis

The second use of the Market Approach in the mass appraisal process is through the application of Multiple Regression Analysis (MRA).

Multiple Regression Analysis (MRA) is a process whereby the computer simulates the actions of the real estate market. MRA may be explained by the following example of linear regression. Assume that sales prices and square feet of improvements are graphed as shown below. With the formula Y=a+bx, a "line of best fit" may be drawn between all of the individual observations to indicate the best relationship available between sales prices and square feet.

This linear regression line (or the equation generated), may then be used to estimate values per square foot on properties which have not sold.

Multiple regression analysis is performed by the formula $Y= a+b_1x_1+b_2x_2+b_3x_3+...+b_nx_n$. In essence, MRA can mathematically set forth a relationship for multiple variables at one time. With the linear example, we could only see the relationship between sales price and square feet (square feet is the variable). With MRA, an unlimited number of variables may be introduced into the equation (such as square feet, grade, number of bedrooms, number of baths, location, etc.). The processing of sales information through MRA allows the process described earlier (i.e. the example about the detached garage) to be applied to all properties within a taxing jurisdiction thus providing a higher degree of accuracy than one might obtain with the more traditional Market Oriented Cost System. A major disadvantage to the use of Multiple-Regression Analysis is that a large number of comparable sales are required. The computer programs will take the actual sales price and assign a factor (similar to the market contribution, but not the same) to each physical characteristic or amenity, which might have been an influence on the sales price. MRA takes sales prices and allocates those sales prices to all the various components which have been pre-determined as value influences. One advantage in using MRA (if adequate sales information is available) is that as part of most programs, various statistical reports are generated, as well as the formulation of the values. Because of the complexities involved in programming, data collection, data verification, and implementation of a MRA System, it is recommended that the City of Boston develop a Market-Oriented Cost System prior to establishing any dependency on a Multiple-Regression System. Historically, implementation of MRA Systems has been a lengthy process. The MRA system recommended for the City of Boston will be available wherever sales justify its use. It will provide an excellent back-up for the cost and income approaches.

3. Gross Income Multipliers

The third general way the market approach is applied in mass appraisal is through the application of Gross Income Multipliers (GIM). The GIM is a factor derived by dividing the price of a property which has been sold by the annual gross income it would generate if rented. The GIM establishes a relationship between gross potential income and value. This relationship, expressed as a factor, provides the appraiser with a method of estimating value for unsold properties by multiplying the gross potential income by the GIM arrived at through market analysis.

The GIM is derived as follows:

$$\frac{\text{Sales Price}}{\text{Gross Potential Income}} = \text{Gross Income Multiplier (GIM)}$$

The GIM, as mentioned above, may be used in the valuation of unsold properties as follows:

Gross Potential Income X Gross Income Multiplier (GIM)=Value

A more complete description of the GIM is discussed later in this section.

4. Mannual Field Reviews

The fourth general way the market approach may be applied is by manual calculation by the field appraisal staff. There will be properties where the values produced by the Cost and Income Approaches do not seem to be accurate. This occasionally happens with older properties since it is difficult to estimate their accumulated depreciation. In these instances field appraisers can be equipped with a printout of sales data, by neighborhood and property type. It will be possible for the appraisers to estimate the value of these properties based upon comparable sales in the same or similar neighborhoods.

B. Specific Applications

1. Market-Oriented Cost Approach

The "market-oriented cost approach" refers to a process of using market sales to verify cost approach appraisals. The process attempts to isolate that portion of the sales price which may be attributable to the improvements. This "Market Improvement Value" is then compared to the cost value for the same property, thus providing a reliable method for monitoring the cost valuations. The entire sales price may also be divided into the appraised value. The "Indices" produced by this process are discussed at length in Subsection C of this section.

2. Multiple Regression Analysis

This section describes the MRA procedure in a step by step approach. Of all the valuation procedures, MRA is by far the most technical. This implies that users be well aquainted with statistics and appraisal procedures to insure successful implementation. The step-by-step procedure will describe the analytic activity which is required to prepare, process and analyze the data.

MRA is based on estimating the market value of property by modeling the pattern of behavior of sales of comparable properties. This requires that the following tasks be performed:

a. Define comparable properties or neighborhoods for modeling purposes.

b. Identify, select, and verify sales within each neighborhood.

c. Store property characteristics at the time of a sale for use in MRA modeling.

d. Extract sales and reformat data for MRA processing.

e. Construct MRA model and analysis.

f. Apply MRA model to all properties in the neighborhood to yield estimated market values.

The step-by-step descriptions below provide detail on each task:

a. <u>Define Neighborhoods of Comparable Properties</u>

Neighborhoods when used in MRA modeling, are defined as collections of properties which might be considered comparable. These neighborhoods need not possess homogeneous groupings nor must they be composed of contiguous land. It is desirable to define these modeling neighborhoods as small groupings of parcels so that the average number of sales per year approximates 10% of the number of parcels used in the analysis. If the neighborhood sizes are initially defined in small enough units, they can later be redefined into larger groups, if necessary.

To illustrate these points, consider two subdivisions as individual neighborhoods. When the number of sales is small or when the pattern of sales indicates that market values in these two subdivisions are behaving in a like manner, then the modeling procedure can combine these subdivisions into one neighborhood.

b. <u>Sales History File</u>

The Sales History File is the most important element of the MRA module. This file contains all sales, with the date of sale, the property identification data, and property characteristics that exist at the time of the sale. Only sales that have been certified as valid "arms-length" transactions should be entered into this file. An "arms-length" sale is also referred to as a bona fide sale. This means that the sales price is considered to be representative of the market value of the property. All sales are not arms-length transactions so a means of disqualifying sales should be established. This simply involves identifying those types of transactions which are not arms-length and deleting them from further consideration as evidence of market value.

The following list provides reasons for deleting a sales transaction from consideration:

1. The sale was a foreclosure.
2. The sale was between related individuals.
3. The sale was between related corporations.
4. The sale was a liquidation sale for estate tax purposes.
5. The sale is too old and therefore not representative of current prices (i.e. 2 or more years old).
6. The sale involved property trade or exchange (as in a "tax-free exchange").
7. There were assumptions of mortgages which are not described in the deed or on which the transfer tax is not known.

Sales that have occurred and have been verified are stored with all the property characteristics that exist at the time of the sale.

c. <u>Neighborhood Profile Analysis</u>

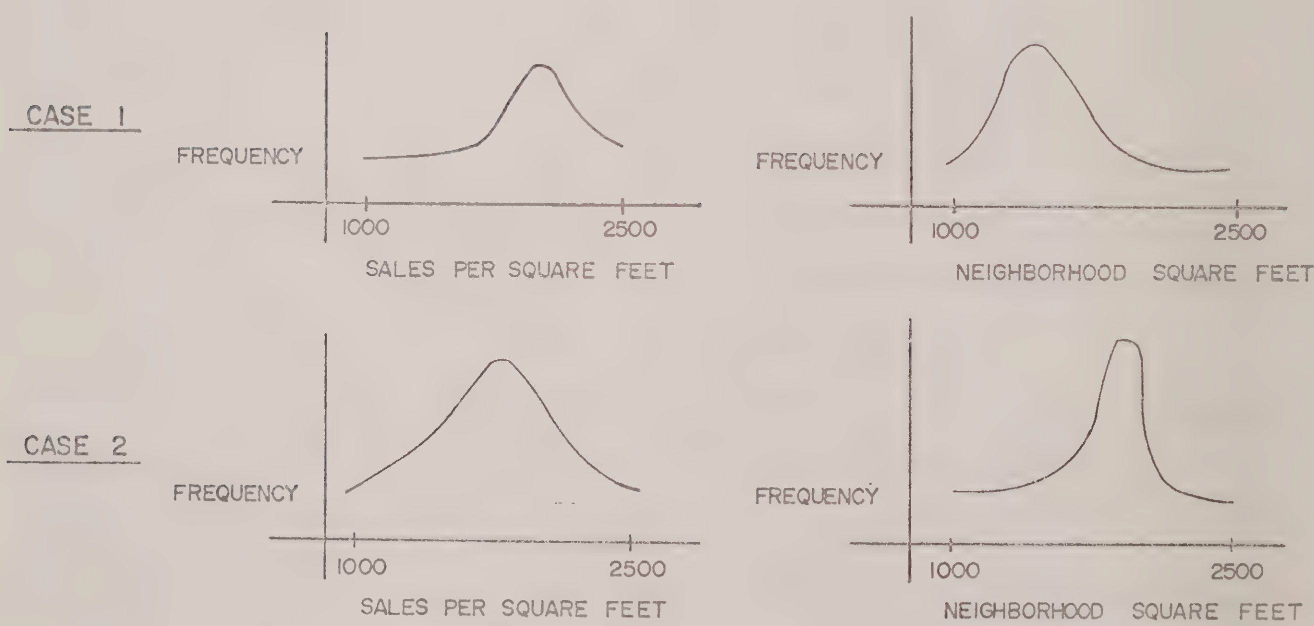
To begin the MRA process, it is necessary to analyze the neighborhood being valued. This analysis produces statistical profiles of selected property characteristics such as square footage, age, condition, grade, story height and number of bathrooms. The statistics of interest include the mean, median, mode, standard deviation and range. This data can be displayed in both printed and graphic form. The graphic form is usually a histogram showing the frequency of occurrence for selected ranges of data. Both the printed and graphic output can be generated by a histogram computer program.

The neighborhood profile analysis is an important step in the sales certification process relative to MRA processing. In order to use sales to build MRA equations, the properties sold must contain property characteristics which are typical for the neighborhood to be valued. Determination of what is typical is performed during neighborhood profile analysis.

d. <u>Sales Profile Analysis</u>

Once the MRA neighborhood code and time frame are known, sales are selected from the sales history file for processing. The user may specify that sales from more than one neighborhood be selected. If this is the case, then the profile analysis in the previous section needs to be altered to reflect this new combination of neighborhoods. Sales are also selected based on the date of sale. If the date specified produces too few sales for analysis, the range can be lengthened (by using older sales) provided the date of sale is used as a variable in the MRA analysis. In fact, it is a good idea to use the date or age of sale as a regression variable.

Once the sales sample is extracted from the sales history file, a statistical profile analysis similar to that mentioned above must be performed and the histograms produced are then compared with each other. To consider the sales sample representative of the neighborhood, these profiles must show similar patterns.



In case 1, the neighborhood pattern of square footage shows that the measure of central tendency is never at the lower end of the square foot range. For sales in case 1, the mean and median appear to be nearer the higher values of the square foot range. It is clear that the sales which occurred do not reflect the typical square footage pattern in the neighborhood. Thus, a re-examination of the neighborhood definition, or more sales, may be needed before proceeding. In case 2, both sales and neighborhood properties show that the mean of the data is the same. Although the dispersion or spread is not identical, it may be reasonable to proceed in this case.

The decision to proceed or not is based upon a thorough examination of many property characteristics. This decision can not be made using only one data item but must be made after considering all data items.

e. Define MRA Variables for Analysis

Any data base element which can be quantified can be used in building the MRA equation. The only restriction which exists is the total number of allowable variables for regression processing. This number is usually defined by the regression program and the core size of the computer being used. The data base items that can be used are one of two types: fixed quantities or yes/no entries. The fixed quantity entries are such items as square footage, age, number of bathrooms, etc. The yes/no variables are those items that indicate the existence of a characteristic such as air conditioning, basements, gas heating, disposal, fireplace, open porch, lawn sprinkler system, family room, first floor laundry, corner lot, schools, etc.

A master list of data base items to be used by neighborhood can be created. This list will be used by the system to extract and reformat the data for analysis.

Developing an MRA equation generally involves two operations: transformation and dichotomization. Transformation of data allows the analyst to use other mathematical functions of existing variables. This is the procedure to redefine a continuous variable into discrete form by stratification. For example, the square footage of living area can be stratified into 3 ranges: less than 1000, between 1000 and 3,000, greater than 3000. To enter this new format to the data, we dichotomize or add three yes/no variables: less than 1000, (yes/no), 1000-3000 (yes/no), greater than 3000 (yes/no). Yes/no variables are usually coded 1=yes,2=no. The process of transformation and dichotomization is part of the MRA system in the selection and extraction of sales data or in the MRA regression program.

The appraiser or analyst determines which characteristics are to be used in equation development based upon examination of neighborhood and sales statistical profiles. Property characteristics may be eliminated from analysis if these items do not exist in both the sales sample and the neighborhood. Items can also be eliminated if the frequency of occurrence is too small. For example, there is only one two-story home in the sales sample.

Assigning a weight to the existence of a two-story home will distort the regression results when applied to other two-story homes. Most users of MRA require at least 5 sales for each characteristic used in the regression.

f. MRA Equation Generation

Once the property characteristics to be processed have been identified and reformatted, the procedure for developing the MRA prediction equation can take place. It is recommended that the MRA computer program, either developed in-house or purchased, utilize a stepwise regression algorithm, which will best handle the problems of multicolinearity and interactions.

The program employs data from the extracted sales file to develop the MRA equation which will be used to predict market value for all properties within a neighborhood. This file is produced when sales are selected for processing, and contains the reformatted variables. The number of sales to be processed must exceed the number of independent variables to be used in the equation.

Almost every MRA computer program using stepwise regression technology is the same except for matters of data entry. The user generally specifies F-levels for acceptable and unacceptable variables. The F-level is a statistical value to test the significance of selected characteristics related to their use in a regression equation.

The MRA equation takes the following form:

ESP=Estimated Selling Price= $A_o+A_1+X_1+A_2+X_{2}+\ldots+A_nX_N$

$X_1, \ldots, X_n$ are calculated by the regression algorithy so that the sum of the squares of the errors is minimal. For example, the equation might become ESP=8000 + (10) (sq. ft) +(500) (existance of fireplace). The coefficients 8000, 10, 500 are calculated by the algorithy. These are chosen so that the sum of the squares of the differences between actual and estimated selling prices is minimal. For the above equation, a property with 2000 sq. ft. containing a fireplace would have an estimated price equal to

ESP =8000 + (10) (2000) + 500 (1)

=8000 + 2000 + 500

= $28,500.

In addition to creating the MRA equation, the computer output includes other useful information:

(1) Mean of all characteristics

(2) Standard Deviation of all characteristics

(3) Correlation between characteristics

(4) Standard Errors of Estimate

3. Gross Income Multiplier

The gross income multiplier (GIM) is calculated as follows:

$$\frac{\text{Sales Price}}{\text{Gross Income}} = \text{GIM}$$

As indicated, it is derived from sales data. It is applied to properties which have not sold, in the following manner:

GIM X Gross Income= Value

The source of the data required to produce GIM's is the Income Table File and the Sales Table File. Once produced, the GIM's will be separated and stored by property type and neighborhood in a "Gross Income Table File".

There are other uses for the GIM. The reciprocal of the GIM is a gross capitalization rate. This gross capitalization rate may be multiplied by the net income ratio for that property type to produce a net overall capitalization rate. This rate may be compared with the rates stored in the Rate Table File. It is recommended that this process of rate calculation (and comparison) be accomplished manually. The conversion of the GIM to a net capitalization rate is as follows:

Gross Income Multiplier = Gross Capitalization Rate

X

Net Income Ratio

= Net Capitalization Rate

Net Capitalization rates may likewise be converted into GIM equivalents as follows:

$$\frac{\text{Net Capitalization Rate}}{\text{Net Income Ratio}} = \text{Gross Capitalization Rate}$$

This source can be used to double-check both the GIM's and capitalization rates. A list of GIM's may be of assistance to field appraisal staff as they canvass an area in the process of reviewing appraisals.

4. Field Review

The field review utilization of the market approach will consist of field appraisal personnel making physical and manual appraisals on properties for which the system produces questionable values.

The field appraisal personnel will be provided with lists of all real estate sales by neighborhood and property type. These, will enable the appraiser to make "on-the-spot" judgements as to value estimates. These manual appraisals will be supported by comparable sales with allowances for differences in time of sale, physical characteristics and location.

The field appraisal personnel will also have a listing, by neighborhood and property type, of the GIM's. These may also be used for field appraisals or for quick double-checks of values produced by the system.

C. Market Analysis Module

1. Overview

This section contains additional methods of utilizing market data. There are five analytical applications of market data which will be presented:

a. Calculation of Market Depreciation

b. Land Values by Abstraction

c. Overview of Market Indices

d. Locational Indices for Land

e. Market Adjustment Factor

2. <u>Specific Applications</u>

a. <u>Calculation of Market Depreciation</u>

A set of depreciation tables to be used in the calculation of depreciation in the Cost Approach will be stored in the system. Tables should have continuing maintenance. If not, the accuracy and legitimacy of the tables will be challenged. The most important reason for checking, and allowing for modification of existing tables is the ever-changing nature of the real estate market. Data used to calculate market depreciation will be retrieved from the Parcel Master File and the Sales History File.

The following formula will be applied to calculate the percent of market depreciation on any sale involving improved property:

$$(RCN- (Sp -L) \div RCN = MD$$

Where:

RCN = Replacement Cost New

SP = Sales Price

L = Land Value

MD = % of Market Depreciation

An additional input is an estimate by the appraiser of the "effective age" of the property. Effective age is defined as "...the age of a similar structure of equivalent utility, condition, and remaining life expectancy as distinct from chronological age; the years of age indicated by the condition and the utility of the structure. This calls for a decision to be made by the appraiser. It may, however, be checked by "backing into" the effective age via the precomputed tables. This is another reason for maintaining a market depreciation file. It may be used as a double check on the decisions of the field staff, thereby providing some assurances of consistent estimates of effective age.

The format of the report will be as follows, allowing for stratification and for viewing the mean depreciation for each year of effective age. This report should be provided at least on a monthly basis.

PERCENT (%) DEPRECIATION

Effective Age	Low Quality	Fair Quality	Average Quality	Very Good Quality	Mean (X) Good Quality
1					
2					
3					
4					
5					
.					
.					
.					
73					
74					
75					

b. <u>Land Value by Abstraction</u>

This section will present two methods utilized by the system to "abstract" land values from sales price of land and improvements. Land values are estimated solely by bonafide market sales. When there are no improvements located on a property which sells, the delineation of sales price per unit of value (front foot or square foot) is a matter of dividing the sales price by the unit measure as follows:

1) Sales price of land ÷ number of front feet = Value per Front Foot

2) Sales Price of land ÷ number of square feet = Value per Square Feet

The City of Boston does not contain a sufficient number of vacant lots or sales of vacant lots to allow for any derivation of land valuation by the above method. For this reason, the Market Analysis Subsystem will calculate the land values from each sale of improved properties. One method of accomplishing this is by abstracting the Replacement Cost New-Less Depreciation (RCNLD) (calculated in the cost portion of the system) from the Sales Price to obtain an estimate of the sales price of the land. This "abstracted land value" is then separated into the desired valuation unit. The process may be viewed as follows:

$(SP-RCNLD) \div FF = SPFF$

$(SP-RCNLD) \div Ft^2 = SP/Ft^2$

SP = Sales Price

RCNLD = Replacement Cost New Less Depreciation

FF = Number of Front Feet

SPFF = Sales Price per Front Foot

Ft^2 = Number of Square Feet of Land

SP/Ft^2 = Sales Price per Square Foot of Land

Another way of abstracting land values from sales prices is the "percentage of value" method. This procedure requires an established percentage of value to be an input item available for entry into the system by an appraisal supervisor who must provide documentation for the figure utilized. The process is as follows:

% LV X SP = LV

Where:

% LV = Percentage of Land Value X Total Value

SP = Sales Price

LV = Land Value

Documentation of estimates should provide the actual sales data used in the determination of a percentage. This might be accomplished by comparing land sales to comparable improved property sales or by the abstraction method on selected sales.

c. <u>Overview of Market Indices</u>

The next two sub-sections are related to the maintenance of the Valuation Models within the overall system. The "indices" (or "adjustment factors") generated may be used in establishing reliable and justifiable percentage factors which may be used to "update" basic figures which are stored in table files. The updated figures are then used to produce new valuations which, because of their derivation from current market data, will provide uniformity and equity.

There sections deal with residential improvements and residential land although other types of land might included if desired. The Cost Table Files and the Sales Table Files will be used in the development of these.

d. <u>Calculation of Locational Indices For Land</u>

The Locational Index for Land is only related to land schedules. The valuation of land is one of the more difficult appraisal tasks encompassed within a system. This is because land may only be valued by using bona fide market sales of unimproved land or abstracting the land from a sales price by way of percentages or by deducting the RCNLD. The actual calculations may be made in one of the following (or both) ways:

1. $L \div (S.P. - RCNLD) = I$
2. $L \div (S.P. \times \%) = I$

This may be illustrated by assuming a RCNLD of $23,400; old land value of $5,104; a land percentage (% of value) of 22%; and a sales price of $30,000:

1. L ÷ (S.P. - RCNLD) = I

   $5,104 ÷ $30,000 - $23,400 = <u>.7733</u>

   or

2. L ÷ (S.P. x %) = I

   $5,104 ÷ ($30,000 x .22) = .7733

The sales are stratified by location (neighborhood) as follows:

N_1IL......N_nIL = Neighborhood Index for Land

	N_1IL	N_2IL	N_3IL --------	N_nIL
Range				
X_{nil}				
Var.				
S.D.				
68% CI				
95% CI				
C.O.V.				

The statistical data, allows the analyst to determine if the mean index is within predetermined tolerances. If so it is chosen for a given neighborhood as a maintenance or updating factor. This process is particularly important in the valuation (or revaluation) of land. Given adequate statistical support and comparability between neighborhoods, the mean for one neighborhood may be used in updating land in a similar neighborhood where there was a scarcity of sales data.

e. <u>Calculation of Market Adjustment Factor</u>

The market adjustment factor (MAF) is computed by dividing the Sales Price minus land value by the RCNLD which is produced by the Cost Approach.

The MAF provides for an adjustment to be used in the cost approach on a neighborhood level. It is known that improved properties possessing similar physical characteristics will have different market values when exposed to different locational influences. This difference is a market reaction and is expressed by the Market Adjustment Factor. Applying the MAF in the cost approach produces a Market-Oriented Cost Valuation. The formula for deriving the Market Adjustment Factor is:

$$(SP-L) \div RCNLD = MAF$$

Where: RCNLD = Replacement cost new less depreciation

L = Land Value (on record)

S.P. = Sales Price

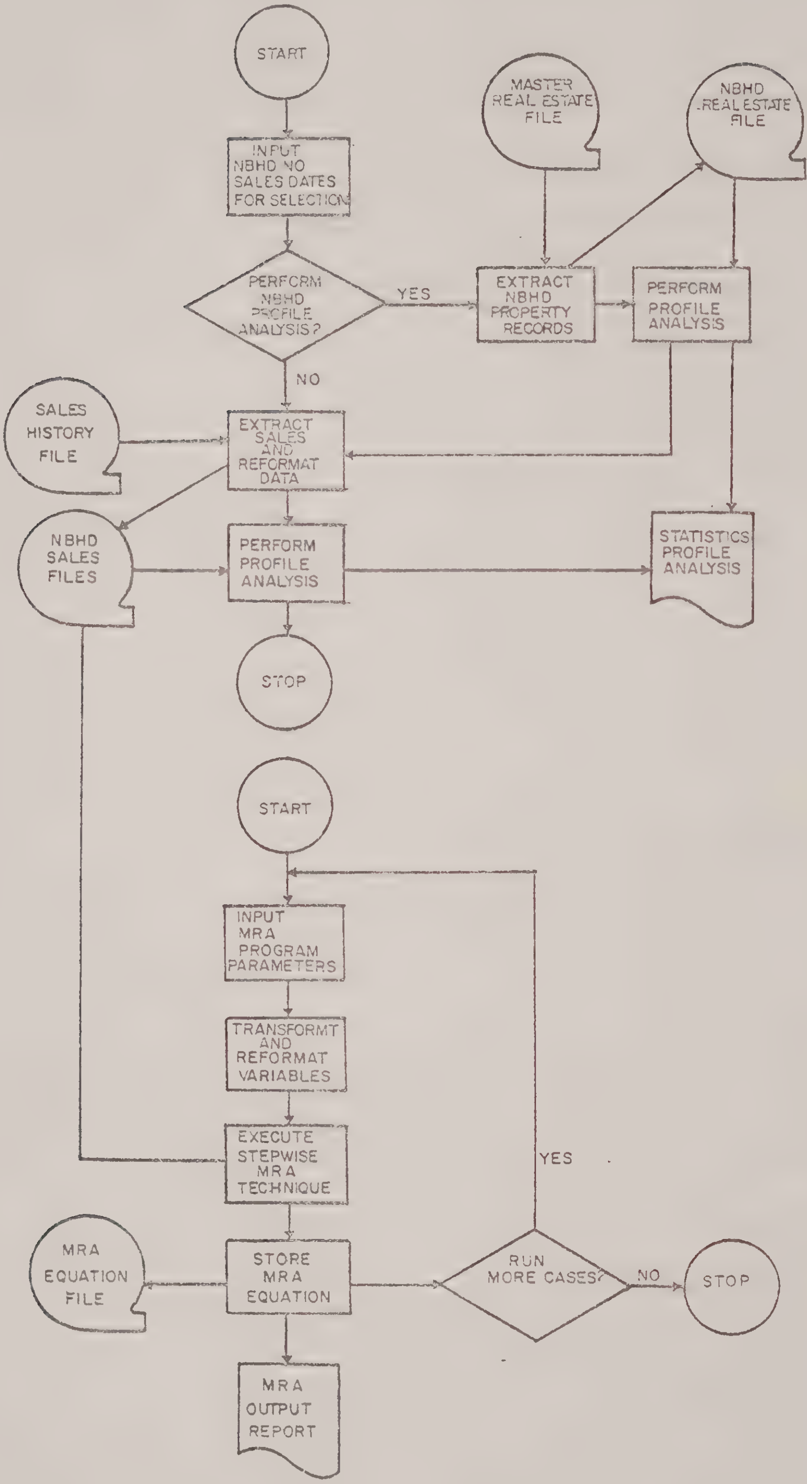
M.A.F. = Market Adjustment Factor

The format for viewing the MAF is by neighborhood number as presented below:

N_1MAF, N_2MAF,..........N_nMAF = Individual market Adjustment Factors

	N_1MAF	N_2MAF	N_3MAF............N_nMAF
Range			
X_{MAF}			
Var			
S.D.			
68% CI			
95% CI			
C.O.V.			

MRA MODULE FLOW CHART



V. LAND VALUATION

A. General Information Concerning Land Valuation

The City of Boston does not have an abundance of open tracts of land. Consequently a large number of sales of open ("raw") land within the City each year does not occur. The land market, therefore, is limited in size and in the number of transactions which are considered to be evidence of value.

Land must, however, be valued and the value estimate must be shown separately for two reasons. First, correct appraisal procedures prescribe that the value of an entire property is comprised of land and building components. These components have respective values which may be estimated and delineated separately. In addition to being proper appraisal procedure, the separation of property value into land and building components is required by law.

There are five methods of valuing land:

1. Direct Sales Comparison
2. Abstraction
3. Anticipated Development
4. Capitalized Ground Rent
5. Allocation of Land/Building Ratios.

The Direct Sales Comparison method is always used in preference to the other four methods. It requires, however, sales of similar raw land for comparison to other raw and improved land. As stated above, there are few such sales in Boston, so reliance will be placed on the other methods.

The Abstraction Method for land valuation abstracts the value of land from the price paid for an improved property in a bona fide and verified sale. The procedure is as follows: Sales Price-Replacement Cost New Less Depreciation= Land Value. This method allows for land value to be calculated from any sale of improved property of any property type.

The Anticipated Development Method of land valuation is used where the appraiser anticipates a change in the current land use to a different use, possibly through subdivision or economic development. This procedure projects the anticipated sales price of the land in the new use with all development costs (i.e. demolition, clearing, grading, etc.) deducted.

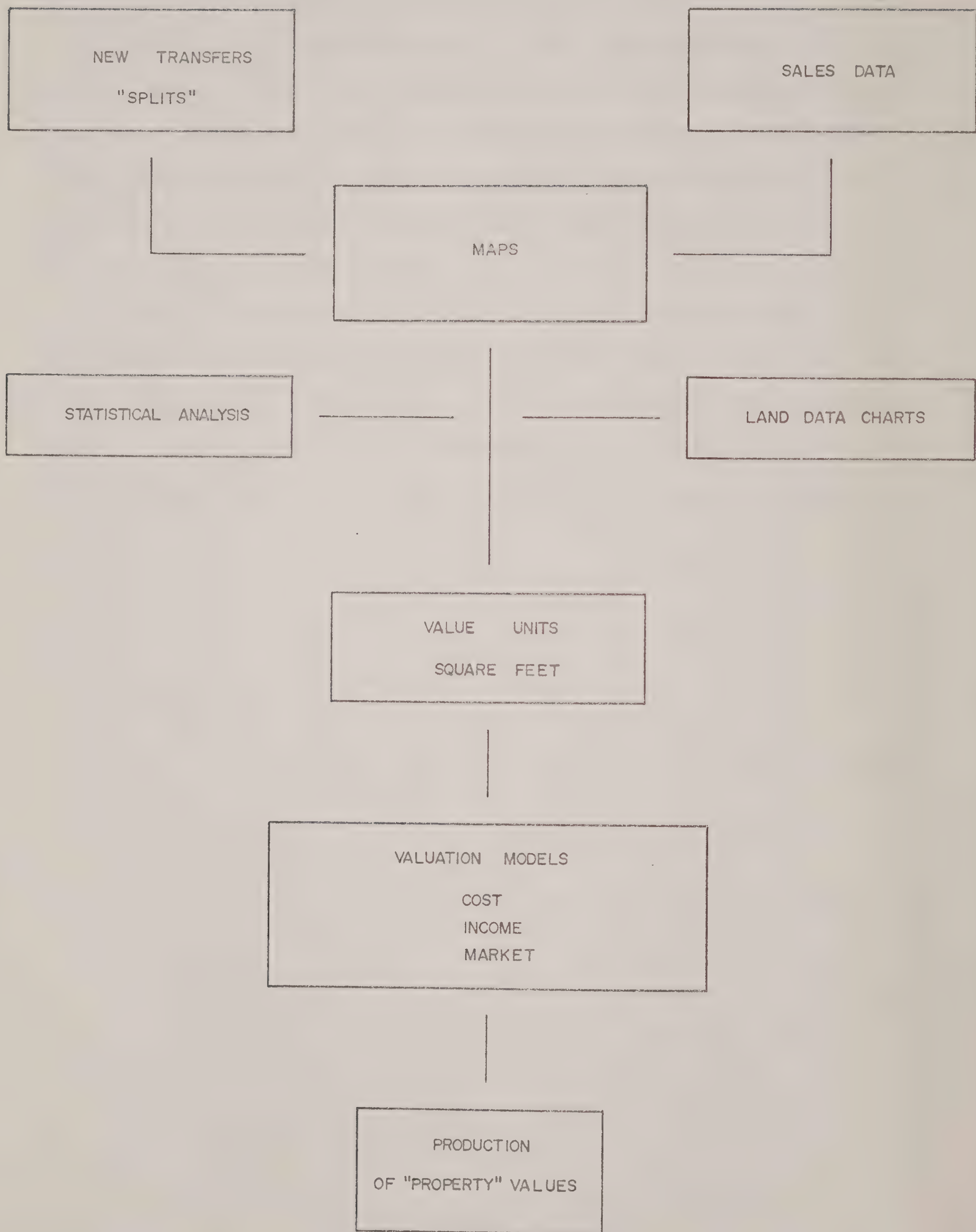
The Capitalized Ground Rent method of land valuation requires an existing ground lease on the subject land or comparable land. This rental income is processed into a net income which is capitalized (by a capitalization rate) into an estimate of value.

The Allocation Method of land valuation utilizes established land-to-building ratios. These are applied to sales prices to obtain estimates of the value of the raw land.

It is recommended by the consultants that a Land Department be established to implement a land valuation system which can encompass all of the above methods of valuation. The values produced by the Land Department will be manually calculated. This manual calculation refers only to production of "value units" which will be inputed into the computer system.

The Land Department will have a complete set of land maps for the entire City. Physical measurements and square footage will be computed and plotted on the maps. All sales of raw land will be placed on the map with accompanying charts for recording the appropriate value unit (the number of square feet), the location, and any unusual characteristics which may differentiate this sale from others (see Land Data Sheet). This information, when captured and recorded on the land data sheet is then analyzed statistically to arrive at the appropriate values per square foot to be used for a given neighborhood. Table Files containing this information will be available for cross-referencing with the other Valuation Models. For an overview of the basic work flow in the Land Department, see the flow chart below.

LAND DEPARTMENT FLOWCHART



B. Specific Tasks for Implementation

The specific tasks involved in the implementation of this Land Valuation Model are outlined below:

1. Establishment of a Land Department
2. Valuation Methods
3. Establish and Store Values
4. Maintenance of Land Model

1. Establishment of a Land Department

The initial task to be accomplished in the equalization of land values will require the establishment of a Land Department The duties of the department will involve specific mapping and plotting tasks, as well as value calculation:

a. Land Maps

The land department must have a complete set of land maps for the City of Boston.

b. Land Measurements and Size

The land maps must have all parcel measurements placed on the maps. The square foot will be the unit of measurement utilized on all types of land for valuation purposes.

c. Plot Land Sales

Vacant land sales, retrieved from the Sales File, must be plotted on the land maps. The appraisers should make notations (eg. color code) for raw land sales versus improved land sales.

2. Methods

There are five methods which will be available to the Land Department in estimating the value of land for all property types and sub-types:

a. Direct Sales Method

b. Abstract Method

c. Anticipated Development Method

d. Capitalized Ground Rent Method

e. Allocation Method

a. Direct Sales Method

The direct sales method requires sales of raw land. The sales price per square foot is calculated as shown below:

Sales Price (from Sales File) ÷ Number of Square Feet (from Land Department)= Value per Square Foot.

b. Abstraction Method

The abstraction method requires sales of improved properties. The sales price is merged with data from the Cost Model to produce a unit value per square foot:

Start:	Sales Price of Land and Improvement (from Sales File)
Less:	Replacement and Cost New Less Depreciation (RCNLD from Cost File)
Equals:	Value of Land
Divided by:	Number of square feet
Equals:	Value per square foot.

A detailed description of this approach is discussed in Section IV, Market Approach to Value.

c. <u>Anticipated Development Method</u>

The anticipated development method is only used where a change in use has occurred. (usually from single to multiple family; raw land to subdivision; residential to shopping center; etc.). The procedure for valuing involves the following steps:

1. Anticipating Sales Price (Sales Price per Unit X number of units).
2. Estimating Clearing Costs (demolition, excavation, etc.).
3. Estimating Grading Costs (Streets, curbs, gutters, sewers, etc.).
4. Estimating Promotional and Sales Expenses
5. Estimating Annual Anticipated Receipts
6. Estimating Annual Net Income
7. Discounting Net Income X Present Value Factor for Value estimate of Land

This process is illustrated for a sample project covering a five year term as follows:

YEAR	CLEARING COSTS	GRADING COSTS	PROMOTIONAL COSTS	SALES EXPENSES	SALES RECEIPTS	NET INCOME X	PRESENT VALUE FACTOR =	PRESENT VALUE
YEAR 1	YEAR 1	YEAR 1	-----	-----	-----	YEAR 1X	F.YEAR 1 =	P.V. YEAR 1
YEAR 2		YEAR 2	YEAR 2	YEAR 2	YEAR 2	YEAR 2X	F.YEAR 2 =	P.V. YEAR 2
YEAR 3		YEAR 3	YEAR 3	YEAR 3	YEAR 3	YEAR 3X	F.YEAR 3 =	P.V. YEAR 3
YEAR 4		------	YEAR 4	YEAR 4	YEAR 4	YEAR 4X	F.YEAR 4 =	P.V. YEAR 4
YEAR 5		------	------	YEAR 5	YEAR 5	YEAR 5X	F.YEAR 5 =	P.V. YEAR 5

Sum of these discounted Present Values = Current Value of Land

÷ number of square feet = Land Value per Square Foot

d. Capitalization Ground Rent

The capitalization of ground rent method can only be used where a ground lease is in existence. The net income from the ground lease is capitalized at an appropriate capitalization rate to arrive at an estimate of value:

Net Annual Income from ground rent ÷ Land Capitalization Rate

= Land Value ÷ No. of Square Feet

= Land Value per Square Foot.

e. Allocation Method

The allocation method of land valuation applies land-to-building ratios (pre-determined from other previously valued properties) to current sales prices. The land-to-building ratio is the percentage of land value to the total value of a property.

Sales Price X Land Ratio = Value of Land

÷ No. Square Feet

= Value per Square Foot

3. Establish and Store Land Value

Once the land values per square foot, have been established, these rates are placed in a Land Table File for use in the other Valuation Models. These values, will have been chosen only after careful analysis and statistical testing by the Land Department.

Values may be listed as illustrated on the following Land Valuation Charts.

4. Maintenance of Land Model

Maintenance of the Land Model is accomplished by the Land Department through the continuing process of:

a. Updating Maps

b. Plotting New Sales/Property Splits

c. Revaluing Land

L A N D D A T A S H E E T

MAP NO.				NEIGHBORHOOD NUMBER
PARCEL I.D NUMBER	SALES PRICE	SIZE	SALES PRICE PER SQUARE FOOT	REMARKS

LAND VALUATION CHART

(R2 -5-)

LOT AREA	PRICE/SQUARE FT	SITE VALUE
3000	\$1.42- \$1.86	4260- 5580
4000	\$1.41- \$1.86	5640- 7440
5000	\$1.40- \$1.85	7000- 9250
6000	\$1.40- \$1.84	8400- 11040
7000	\$1.39- \$1.84	9730- 12880
8000	\$1.38- \$1.83	11040- 14640
9000	\$1.37- \$1.82	12330- 16380
10000	\$1.36- \$1.81	13600- 18100

LAND VALUATION CHART

(R-5 - R-20)

LOT AREA	PRICE/SQUARE FT.	SITE VALUE
3000	$1.40- $1.84	4200- 5520
3500	$1.39- $1.84	4865- 6640
4000	$1.38- $1.83	5520- 7320
4500	$1.37- $1.82	6165- 8190
5000	$1.37- $1.81	6850- 9050
5500	$1.36- $1.80	7480- 9900
6000	$1.35- $1.80	8100- 10800
6500	$1.34- $1.79	8710- 11635
7000	$1.34- $1.78	9380- 12460
7500	$1.33- $1.78	9975- 13350
8000	$1.33- $1.77	10640- 14160
8500	$1.33- $1.76	11220- 14960
9000	$1.31- $1.76	11790- 15840
9500	$1.30- $1.75	12350- 16625
10000	$1.30- $1.74	13000- 17400
10500	$1.29- $1.74	13545- 18270
11000	$1.28- $1.73	14080- 19030
11500	$1.28- $1.73	14720- 19895
12000	$1.27- $1.72	15240- 20640
12500	$1.27- $1.72	15875- 21500
13000	$1.26- $1.71	16380- 22230
13500	$1.25- $1.70	16875- 22950
14000	$1.25- $1.69	17500- 23660
14500	$1.24- $1.69	17980- 24505
15000	$1.24- $1.68	18600- 25200
15500	$1.23- $1.67	19065- 25885
16000	$1.22- $1.66	19520- 26560
16500	$1.21- $1.66	19965- 27390
17000	$1.21- $1.65	20570- 28050
17500	$1.20- $1.64	21000- 28700
18000	$1.19- $1.63	21420- 29340
18500	$1.19- $1.63	22015- 30155
19000	$1.18- $1.62	22420- 30780
19500	$1.17- $1.61	22810- 31395
20000	$1.16- $1.60	23200- 32000

LAND VALUATION CHART

(R-5 - R-20)

LOT AREA	PRICE/SQUARE FT.	SITE VALUE
20500	\$1.15- \$1.59	23575- 32595
21000	\$1.14- \$1.58	23940- 33180
21500	\$1.14- \$1.58	24510- 33970
22000	\$1.13- \$1.57	24860- 34540
22500	\$1.13- \$1.57	25425- 35324
23000	\$1.12- \$1.56	25760- 35880
23500	\$1.12- \$1.56	26320- 36660
24000	\$1.11- \$1.55	26640- 37200
24500	\$1.10- \$1.54	36950- 37730
25000	\$1.10- \$1.54	27500- 38500
25500	\$1.09- \$1.52	27795- 38760
26000	\$1.07- \$1.51	27820- 39260
26500	\$1.07- \$1.50	28355- 39750
27000	\$1.06- \$1.50	38620- 40500
27500	\$1.05- \$1.49	28875- 40975
28000	\$1.04- \$1.48	29120- 41440
28500	\$1.04- \$1.48	29640- 42180
29000	\$1.03- \$1.47	29870- 42630
29500	\$1.02- \$1.46	30090- 43070
30000	\$1.02- \$1.46	30600- 43800
30500	\$1.01- \$1.45	30805- 44225
31000	\$1.00- \$1.44	31000- 44640
31500	\$1.00- \$1.43	31500- 45045
32000	\$0.99- \$1.42	31680- 45440
32500	\$0.98- \$1.42	31850- 46150
33000	\$0.98- \$1.41	32340- 46530
33500	\$0.97- \$1.40	32495- 46900
34000	\$0.96- \$1.40	32640- 47600
34500	\$0.96- \$1.40	33120- 48300
35000	\$0.95- \$1.39	33250- 48650
35500	\$0.94- \$1.38	33370- 48990
36000	\$0.94- \$1.37	33840- 49320
36500	\$0.93- \$1.36	33945- 49640
37000	\$0.92- \$1.36	34040- 50320
37500	\$0.92- \$1.35	34500- 50625

LAND VALUATION CHART

(R-5 - R-20)

LOT AREA	PRICE/SQUARE FT.	SITE VALUE
38000	$0.91- $1.34	34580- 50920
38500	$0.91- $1.34	34650- 51590
39000	$0.91- $1.33	35100- 51870
39500	$0.89- $1.32	35155- 52140
40000	$0.88- $1.31	35200- 52400
40500	$0.87- $1.31	35235- 53055
41000	$0.87- $1.30	35670- 53300
41500	$0.86- $1.29	35690- 53535
42000	$0.85- $1.28	35700- 53760
42500	$0.85- $1.28	36125- 54400
43000	$0.84- $1.27	36120- 54610
43500	$0.83- $1.26	36105- 54810
44000	$0.82- $1.26	36080- 55440
44500	$0.82- $1.25	36490- 55625
45000	$0.81- $1.24	36450- 55800

LAND VALUATION CHART

(Industrial)

LOT AREA	PRICE/SQUARE FT.	SITE VALUE
5000	\$2.50- \$3.50	12500- 17500
10000	\$2.50- \$3.50	25000- 35000
15000	\$2.50- \$3.50	37500- 52500
20000	\$2.50- \$3.50	50000- 70000
25000	\$2.50- \$3.50	62500- 87500
30000	\$2.30- \$3.15	69000- 94500
35000	\$2.30- \$3.15	80500-110250
40000	\$2.25- \$3.15	90000-126000
45000	\$2.25- \$3.00	101250-135000
50000	\$2.25- \$3.00	112500-150000
55000	\$2.20- \$2.95	121000-162200
60000	\$2.20- \$2.95	132000-177000
65000	\$2.15- \$2.90	129700-188500
70000	\$2.10- \$2.90	150500-203000
75000	\$2.10- \$2.90	157500-217500
80000	\$2.10- \$2.90	168000-232000
85000	\$2.10- \$2.90	178500-246500
90000	\$2.10- \$2.90	189000-261000
95000	\$2.10- \$2.90	199500-275500
100000	\$2.10- \$2.85	210000-285000
105000	\$2.10- \$2.85	220500-299200
101000	\$210.- \$2.85	231000-313500
115000	\$2.10- \$2.85	241500-327700
120000	\$2.10- \$2.85	252000-342000
125000	\$2.10- \$2.85	262500-356200
130000	\$2.10- \$2.85	273000-370500
135000	\$2.10- \$2.85	283500-384700
140000	\$2.05- \$2.80	387000-392000
145000	\$2.05- \$2.80	297200-406000
150000	\$2.05- \$2.80	307500-420000

LAND VALUATION CHART

(Industrial)

LOT AREA	PRICE/SQUARE FT.	SITE VALUE
155000	$2.05- $2.80	317700- 434000
160000	$2.05- $2.80	328000- 448000
165000	$2.05- $2.80	338200- 462000
170000	$2.00- $2.70	340000- 459000
175000	$2.00- $2.70	350000- 472500
180000	$2.00- $2.70	360000- 486000
185000	$2.00- $2.70	370000- 499500
190000	$2.00- $2.70	380000- 513000
195000	$2.00- $2.70	390000- 526500
200000	$2.00- $2.70	400000- 540000
205000	$2.00- $2.70	410000- 553500
210000	$2.00- $2.70	420000- 567000
215000	$2.00- $2.70	430000- 580500
220000	$2.00- $2.70	440000- 594000
225000	$1.95- $2.75	438700- 618700
230000	$1.95- $2.75	448500- 632500
235000	$1.95- $2.75	458200- 646200
240000	$1.95- $2.75	468000- 660000
245000	$1.95- $2.75	477700- 673700
250000	$1.90- $2.70	475000- 675000
255000	$1.90- $2.70	484500- 688500
260000	$1.90- $2.70	494000- 702000
265000	$1.95- $2.70	503500- 715500
270000	$1.90- $2.70	513000- 729000
275000	$1.95- $2.65	522500- 728700
280000	$1.90- $2.65	532000- 742000
285000	$1.90- $2.65	541500- 755200
290000	$1.90- $2.65	551000- 768500
295000	$1.85- $2.60	5457000- 767000
300000	$1.85- $2.60	555000- 780000

VI. UNIQUE PROPERTIES

A. General Overview

Although a mass appraisal is designed to value properties "in the mass", there are certain properties which are unusual in architectural design, construction materials and use. These are termed "unique properties" because they are usually one of a kind, designed for a specific use and not adaptable to other uses. Fenway Park, Boston Garden, and the City Hall Building are examples.

Unique properties may be churches, museums, special purpose industrial properties, or civic centers. The System Table Files will not contain data for valuation of these unusual properties. These unique improvements will require individual appraisals, and the data used to value one unique property will not, with the possible exception of land data, be of assistance in the valuation of another one. Cost data will have to be generated locally, possibly with the assistance of national cost service manuals.

B. Specific Tasks

The specific tasks relating to the eventual valuation of unique properties are:

1. Location of Properties
2. Assignment of Personnel
3. Collection of Data
4. Valuation of Unique Property

1. Location of Property

The first task to be accomplished is to locate the number of unique properties existing in the City of Boston. This may be accomplished by a research staff. If the types and number of unique properties are such that they may be stratified into "Unique Groups" such as churches, historical buildings, museums, etc. this should be also done by the research staff.

It should be noted that this step will be a one-time effort. Once properties have been located and initial data collection completed, maintenance should be done by the appraisers assigned to that task.

2. <u>Assignment of Personnel</u>

A team of specialized personnel will have to be assigned to value unique properties. The actual number of appraisers will depend on the number of properties to be valued. Specific time guidelines for unique property valuation cannot be established until the properties have been initially located and research begun.

3. <u>Collection of Data</u>

Research efforts should be designed so as to keep the appraiser up-to-date on all findings. The appraisal staff should be involved in all analyses because the accuracy of their procedures are dependent on the quality of the data gathered. The type of data to be gathered include:

a. Economic base information of the area as it relates to the property type (demographics, labor, industry, amenities, etc.).

b. National and regional search for possible sales of other similar antique properties. Many times the real estate market for unusual properties is national in scope.

c. Architects plans for the property should be obtained and studied for type and quality of condition.

d. The local, regional and national market should also be reviewed for possible comparable rentals involving similar unique properties.

4. Valuation of Unique Property

The last task will involve an estimation of the value of each unique property. This will probably place primary consideration on cost data since any improved property may be valued with the cost approach. When income data are considered to be stable enough as to project an annual income over a specific period, the income approach will be utilized. If regional and national research yields any sales of comparable unique properties, the market approach will also be applied.

VII. PERFORMANCE ANALYSIS

A. General Overview

There is a continuing need for quality control or performance analysis in any fully implemented system. Performance Analysis is, in essence, determining the performance quality of an operating system.

This is accomplished through collection, verification, stratification, and analysis of real estate sales data. The best evidence of full and fair cash value is the sales price in a bona fide market transaction. Once the sales price of a property has been verified, it may be used as an indicator of the accuracy of appraisals of the same property. The assessment - sales ratio is the method that is used to compare sales prices with appraisals. This ratio is obtained by dividing the assessed value by the sales price thusly,

$$\text{SALES ASSESSMENT RATIO} = \frac{\text{ASSESSED VALUE}}{\text{SALES PRICE}}$$

The assessment ratio's usefulness lies in its aptness for further analysis. While the individual ratio on a given property provides a useful measure of the accuracy of the assessment, ratios are required on a number of sales before estimates of assessment uniformity can be made. When viewing a large number of ratios (for instance, all sales within the City of Boston in one year), one may calculate the average or "mean" ratio (denoted by the symbol "$\bar{X}$"). This simply provides an indication of the average ratio that occured in a given area over the specified time period.

This "average ratio" is useful as a general indicator but does not provide any information about the range of the ratios, or how much variation there might be within that range. For example, an average (mean or $\bar{X}$) ratio is calculated to be 96% in an area with a legal assessment level of 100%. The initial impression is that the level of actual assessments to sales is very close to the required 100%. However, closer examination might reveal that the range of ratios was from 35% to 155% and that, in actuality, very few individual ratios fell around the 96% mean ratio. In other words, without some indication of the spread between the individual ratios, a ratio study cannot be used to measure actual assessment performance.

The mean ratio is one way to measure assessment performance. Another is the median ratio. Ratios may be ordered in sequence from lowest to highest. This is an array. The ratio which has the same number above or below it is the median ratio.

An advantage of the median over the mean ratio is that the median is not as sensitive to extreme high or low rates. Most of the ratios in a sample might fall between 80% and 90%, but several below 30% will lower the mean ratio. To illustrate, assume the following ratios:

RATIOS	ARRAYED	
.88	.30	
.82	.82	
.30	.88	middle = .88 ($\bar{X}mr$)
.90	.90	
1.000	1.00	
	3.90 ÷ 5 = .78 mean ($\bar{X}_R$)	

The mean ratio of .78 is significantly below the median because of the low .30 ratio. Without the influence of the single low ratio, the median would be .89 and the mean would be .90.

$$
\begin{array}{r l}
.82 & \\
.88 & \\
.90 & 1.78 \div 2 = .89\ (\bar{X}_R) \text{ median ratio} \\
\underline{1.00} & \\
3.60 & \div\ 4 = .90\ (\bar{X}_R) \text{ median ratio}
\end{array}
$$

The disadvantage of relying solely on the median, instead of the mean, is that it does not lend itself as well to statistical analysis. The composite assessment-sales ratio analysis set forth below utilizes both the mean and the median. Since both have distinct advantages, both may be used, as long as the inherent limitations of each are recognized.

B. <u>Statistical Tools for Analysis</u>

The statistical tools which should be utilized in a thorough analysis of sales, along with descriptions of their applicability, are presented below. It should be noted that these same analytical tools may be used to analyze other data in addition to the assessment ratio.

1) X = Ratio
2) Range
3) Array

4) Frequency Distribution

5) Histogram

6) $\bar{X}_R$ = Mean Ratio

7) $\bar{X}_{MR}$ = Median Ratio

8) $\bar{X}_{AR}$= Aggragate Ratio

9) $\bar{X}_{AD}$ = Average Deviation

10) C.O.D. = Coefficient of Dispersion

11) Var. = Variance

12) S.D. Standard Deviation

13) 68% CI = 68% Confidence Interval

14) 95% CI = 98% Confidence Interval

15) C.O.V. = Coefficient of Variation

16) P.R.D. = Price Related Differential

1. Ratio: The individual ratio (X) has been discussed above. It represents the mathematical relationship betwen a sales price on a property and the assessed value of the same property. The ratio is a shortened version of what is often referred to as the "assessment sales ratio" or the "sales ratio".

$$\text{RATIO} = \frac{\text{ASSESSED VALUE}}{\text{SALES PRICE}}$$

Ratios provide a method of measuring the accuracy of an individual appraisal and the uniformity and equity among a large number of appraisals.

2. Range: The range refers to the lowest and highest-values in a distribution of numbers. These represent the outer limits or boundaries within which all other numbers will fall. For example, the ratios may "range" from 25% to 130%, meaning that all other ratios within the ratio study fall within those percentages (25%-130%).

3. Array: An array of numbers is a listing from lowest to highest in sequence. The seven ratios below are first listed randomly, then arrayed.

"X"	Array "X"
1.10	.55
.75	.60
.60	.75
1.05	.86
.95	.95
.86	1.05
.55	1.10

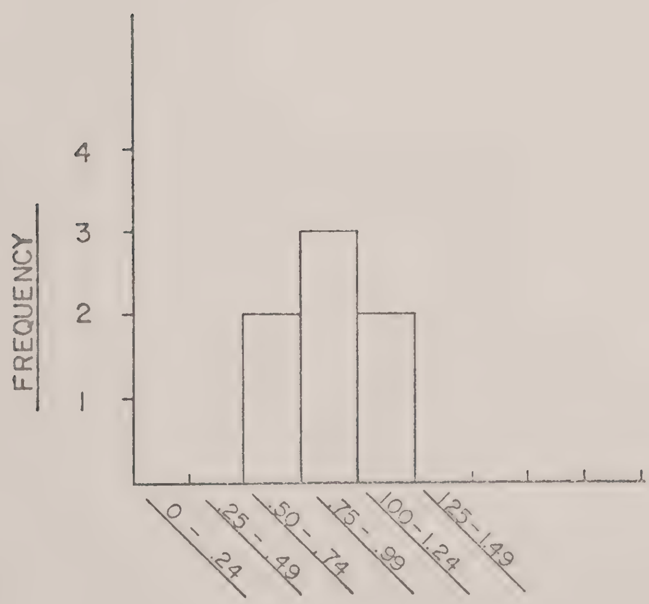
4. Frequency Distribution: A frequency distribution is a listing of the number of items that fall within specified intervals. An example of a frequency distribution for the seven ratios listed above is as follows:

"X"	Frequency Distribution Intervals	(25% Intervals) # Items
.55		
.66	0 - .24	0
.75	.25 - .49	0
.86	.50 - .74	2
.95	.75 - .99	3
1.05	1.00 - 1.24	2
1.10	1.25 - 1.49	0

The frequency distribution above shows at a glance that the ratios presented fall between the .50 and 1.25 interval range, and that more of these are clustered in the .75 - .99 interval than are clustered in any other interval.

5. Histogram: A histogram is simply a graphic presentation of a frequency distribution. It allows visual interpretation of the data contained in the frequency distribution. A histogram of the ratios presented above would look like this:

HISTOGRAM



6. <u>Mean Ratio</u> ("$\bar{X}_R$"): The mean ratio ($\bar{X}_R$) is the arithmetic average of a series of given ratios. It is calculated by dividing the sum (sum = "Σ" = sigma) of the individual ratios ("X_R") by the number of ratios ("N"). This may be seen as:

$$\frac{\text{Sum of ratios}}{\text{Number of ratios}} = \text{Mean Ratio } \frac{\Sigma X_R}{N} = \bar{X}_R$$

"X"
.55
.60
.75
.86
.95
1.05
1.10

$\Sigma X = 5.86$

7. <u>Median Ratio</u> ("$\bar{X}_{MR}$"): The median ratio, as presented earlier describes that number which is precisely in the middle of an array. This means that there will be as many items beneath it as there are above it. If the array has an even number of items, the middle two are averaged together to obtain the median. The median for the above data is:

"X"	
.55	
.60	
.75	
.86	Median Ratio ($\bar{X}_{MR}$)
.95	
1.05	
1.10	

8. Aggregate Ratio ("$\bar{X}_{AR}$"): The aggregate ratio is the sum of all selling prices divided into the sum of all assessed values. The Aggregate Ratio is used in development of the Price Related Differential, which will be described below. From a statistical standpoint, the aggregate ratio by itself is not particularly useful since it provides no meaningful interpretation of the accuracy, equity, or uniformity of the ratio presented.

9. Average Deviation ($\bar{X}_{AD}$): The average deviation describes the absolute average deviation from the measure of central tendency (mean or median) for a series of ratios. The average deviation calculated about the median for seven individual ratios would be as follows:

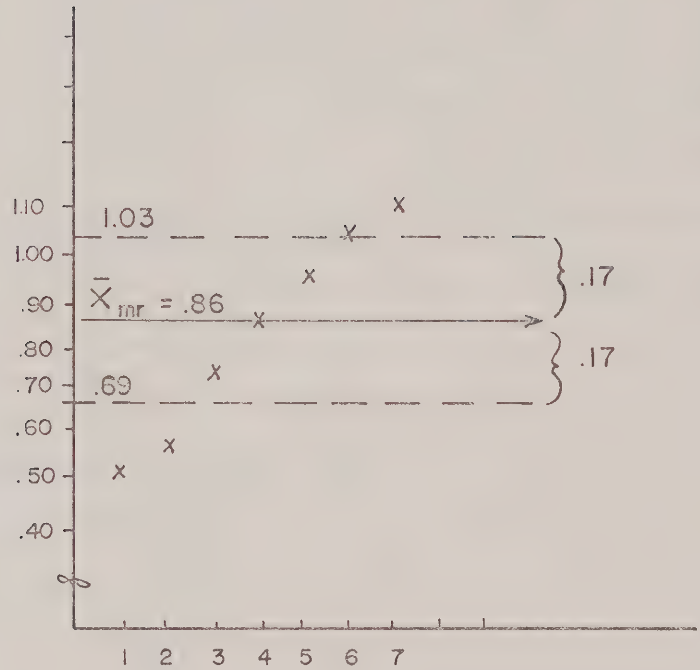
	"X_R"	$X_R - \bar{X}_{MR}$
	.55	.31
	.60	.26
	.75	.11
Median ratio ($\bar{X}_{MR}$) =	.86	.00
	.95	.09
	1.05	.19
	1.10	.24
		1.20

$$\bar{X}_{AD} = \frac{(X_R - \bar{X}_{MR})}{N}$$

$$\bar{X}_{AD} = \frac{1.20}{7}$$

$$\bar{X}_{AD} = .17$$

The average deviation calculated around the median for the above ratios is .17. The actual ratios and the average deviation are presented graphically below.



The graph shows that while the ratios ranged from .55 to 1.10, the average deviation from the median of .86 was $\pm$ .17 (from .69 to 1.03).

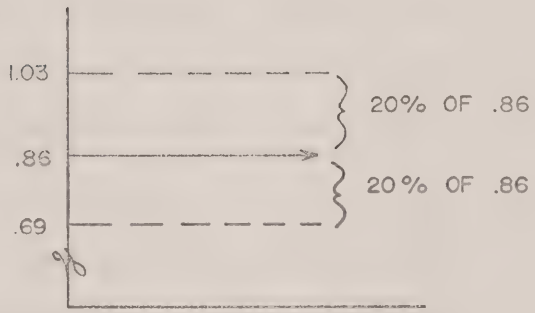
10. <u>Coefficient of Dispersion (C.O.D.)</u>: The coefficient of dispersion is simply the average deviation expressed as a percentage of the mean or median (whichever is chosen).

<u>COEFFICIENT OF DISPERSION (C.O.D.)</u>

$$\text{C.O.D.} = \frac{\bar{X}_{MD}}{\bar{X}_{MR}}$$

$$\text{C.O.D.} = \frac{.17}{.86}$$

$$\text{C.O.D.} = \underline{\underline{.20}}$$



From the distribution above, the C.O.D. would be .20. This means that the average deviation from the mean was 20% in the selected sample. In an assessing system, this C.O.D. would indicate that the system (given a representative sample) is assessing property at an average of 86%, of full market value. However, the dispersion as a percentage is 20% above and below this average.

In assessment practice, a C.O.D. of less than 20% is an acceptable standard in the measurement of assessment equity. The C.O.D. is a relative measure of dispersion because it relates to the mean or median. Many assessment jurisdictions favor use of the median rather than the mean. The median ignores extreme ratios, either high or low. Using the median would have the effect of showing an average which was not affected by one or two high ratios or one or two low ratios. However, it could be that the low ratios ignored by the median are systematic of an appraisal problem within one of the valuation schedules utilized by the system. Unless one reviewed the mean and the median together, this might not be discovered. The calculation of the Coefficient Of Dispersion should be around both the mean and median. This allows the appraiser/analyst to see the dispersion about both the mean and the median thus giving a more complete view of the ratios presented. From a mathematical point of view, use of the median does not allow for further statistical analysis. The mean does however, and will be used in further analysis in this report. The ratios presented above are now shown below with C.O.D. calculated for both mean and median. The lowest ratio of .55 is then changed to .10 to illustrate the effect of extreme ratios on the interpretation of a ratio study.

X_R	$X_R - \bar{X}_R$	$X_R - \bar{X}_{MR}$	
.55	.29	.31	
.60	.24	.26	
.75	.09	.11	
.86	.02	.00	
.95	.11	.09	Mean and Median nearly equal
1.05	.21	.19	
1.10	.26	.24	
$\bar{X}_R = .84$	$\bar{X}_{MD} = .17$	$\bar{X}_{MD} = .17$	
$\bar{X}_{MR} = .86$	COD = .20	COD = .20	

X_R	$X_R - \bar{X}_R$	$X_R - \bar{X}_{MR}$	
.10	.67	.76	
.60	.17	.26	
.75	.02	.11	
.86	.09	.00	Mean and Median far apart
.95	.18	.09	
1.05	.28	.19	
1.10	.33	.24	
$\bar{X}_R = .77$	$\bar{X}_{MD} = .25$	$\bar{X}_{MD} = .24$	
$\bar{X}_{MR} = .86$	COD = .32	COD = .28	

Significant difference between the mean and the median results from significant differences within the ratios sampled and, by implication, from inequities within the valuation system which produced the inequitable ratios. It might be noted from the above calculation that when extreme ratios are present, there is a significant difference between the mean ratio ($\bar{X}_R$) and median ratio ($\bar{X}_{MR}$). This further manifests itself in the Coefficient of Dispersion (C.O.D.) calculated from each. It would be entirely possible, therefore, to achieve a desired ratio level using the median when use of the mean might have precluded the desired results.

At the very least, the appraiser/analyst should be aware of the advantages and disadvantages inherent in the use of a particular analytical method or tool.

11. <u>Variance (Var.)</u>: The "variance" of a distribution is the average of the squared deviations from the mean. The significance of the variance for analytical purposes is in calculating its square root, the standard deviation. The variance is calculated by the following formula:

$$\text{Var.} = \frac{\sum (X_R - \bar{X}_R)^2}{N-1}$$

12. Standard Deviation (S.D.): The standard deviation is (mathematically) the square root of the variance. In concept, it could be considered similar to the average deviation. Both describe deviations from the mean. The standard deviation may, however, be only calculated from the mean and has the distinct advantage of having predictive capabilities. Calculation of the standard deviation is accomplished by taking the square root of the variance. The variance and standard deviation of the seven ratios enumerated earlier are:

$$\text{Var.} = \frac{\Sigma(X_R - \bar{X}_R)^2}{N-1}$$

$$\text{S.D.} = \sqrt{\frac{\Sigma(X_R - \bar{X}_R)^2}{N-1}}$$

X_R	$(X_R - \bar{X}_R)$	$(X_R - \bar{X}_R)^2$
.55	.29	.0841
.60	.24	.0576
.75	.09	.0081
.86	.02	.0004
.95	.11	.0121
1.05	.21	.0441
1.10	.26	.0676
$\bar{X}_R = .84$		$(X_R - \bar{X}_R)^2 = .2740$

$$\text{Var.} = \frac{.2740}{6}$$

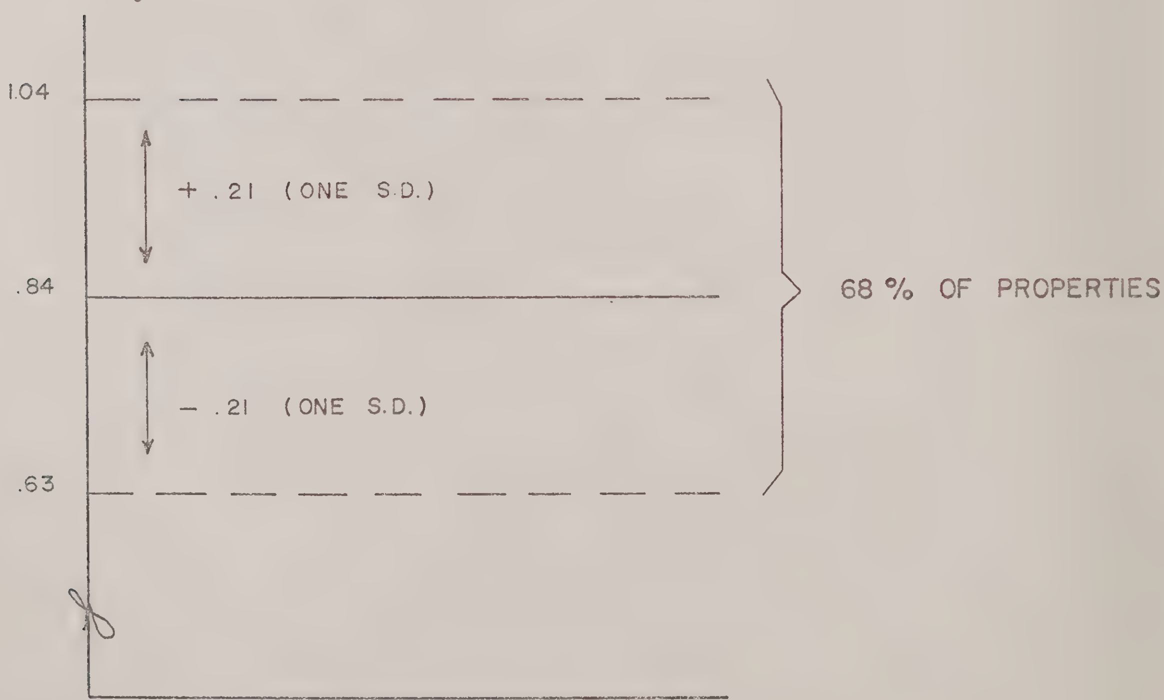
$$\text{Var.} = .0457$$

$$\text{S.D.} = \sqrt{.0457}$$

$$\text{S.D.} = .21$$

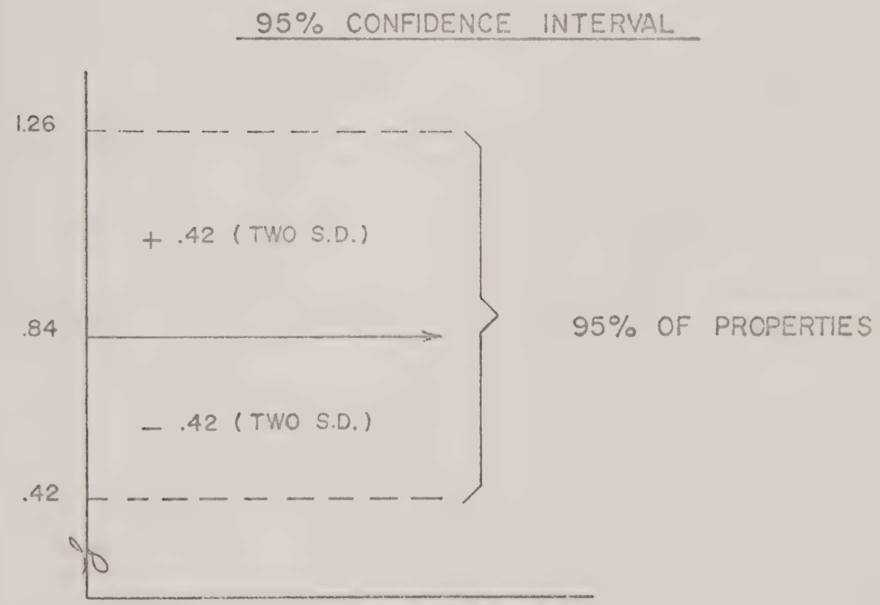
The utility of a standard deviation is its ability to predict the behavior of an entire population, based on the behavior of a sample. This predictability is dependent upon random selection of samples that are representative of the entire population. This predictability is expressed by establishing confidence intervals at various points of standard deviation.

13. <u>68% Confidence Interval</u>: Sixty eight (68%) percent of all items are considered to fall within plus or minus one standard deviation from the mean. For example, the standard deviation for the sample above is .21. The distribution of this around the mean may be viewed as follows:



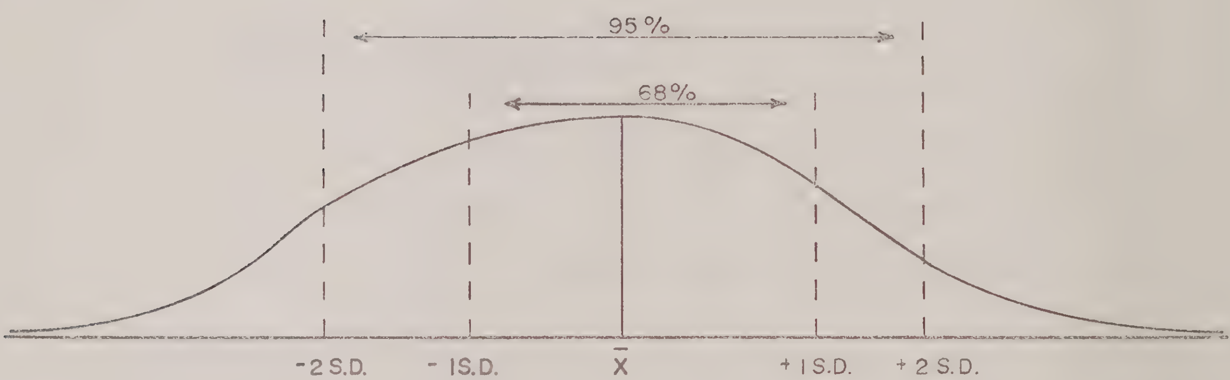
This tells us that the system which appraised the sample properties is appraising 68% of all other properties at assessment ratio levels between .63 and 1.04.

14. <u>95% Confidence Interval</u>: Ninety-five (95%) percent of all items are considered to fall within plus or minus two standard deviations from the mean. Using the same example as above (S.D. = .21; $\bar{X}_R$ = .84) the distribution of this around the mean might graphically be viewed below:



This graph tells us that this system can be expected to appraise 95% of all properties at an assessment level between .42 and 1.26.

Another view of the confidence intervals presented illustrates on a horizontal scale the relationship of items when one assumes a normal curve is present.



This shows that 68% of all items may be found within $\pm$ 1 S.D. from the mean and the 95% of all items may be found within $\pm$ 2 S.D. from the mean.

The significance of all this to property appraisals and assessment ratios, etc. is that the standard deviation, coupled with the confidence intervals, provides a method of predicting the overall accuracy of a system from samples of sales.

15. Coefficient of Variation (C.O.V.): There are no established numbers that indicate when uniformity or equity has been accomplished for a given range within one or two standard deviations. There is, however, a relative measure of dispersion for the standard deviation This is the Coefficient of Variation. The Coefficient of Variation is the standard deviation divided by the mean ratio. For the distribution used earlier,

$$\text{Coefficient of Variation (C.O.V.)} = \frac{\text{S.D.}}{\bar{X}_R} \quad \frac{.21}{.84} =$$

the coefficient of Variation would be .25. The C.O.V. is to the S.D. as the C.O.D. is to the $\bar{X}_{MD}$

$$\frac{\bar{X}_{MD}}{\bar{X}_R} = \text{C.O.D.}$$

$$\frac{S.D.}{\bar{X}_R} = C.O.V.$$

The difference is that the C.O.D. is terminal. No further analysis may be made. The C.O.V. allows for the establishment of confidence intervals and other statistical testing if desired.

16. Price Related Differential. This is a tool for viewing the weighted effect of larger sales prices to assessments in a ratio study. The P.R.D. is calculated by dividing the mean ratio ($\bar{X}_R$) by the aggregate ratio ($\bar{X}_{AR}$).

$$P.R.D. = \frac{\bar{X}_R}{\bar{X}_{AR}}$$

If the P.R.D. is greater than 1.00, the assessment system is overvaluing lower-priced properties. If the P.R.D. is less than 1.00 the system is overvaluing higher priced properties. The P.R.D. is a measure with which to gauge whether or not a given system is discriminating against certain types of properties. Differences between the mean ratio and the mean average ratio occur because the aggregate ratio is easily influenced by higher prices in relation to assessments. Examples of the calculations involve for the P.R.D. resulting in numbers both below and above 1.00 are shown below:

A. <u>P.R.D. below 1.00</u>

Sales Price	Assessed Value	Ratio
125,000	135,000	1.08
100,000	110,000	1.10
80,000	90,000	1.13
50,000	50,000	1.00
40,000	35,000	.88
30,000	25,000	.83
25,000	20,000	.80
$450,000	$465,000	$\bar{X}_R = .97$

$$\bar{X}_{AR} = \frac{\$465,000}{\$450,000} = 1.03$$

$$\text{P.R.D.} = \frac{\bar{X}_R}{\bar{X}_{AR}} = \frac{.97}{1.03} = \underline{.94}$$

B. P.R.D. above 1.00

Sales Price	Assessed Value	Ratio
125,000	100,000	.80
100,000	83,000	.83
80,000	70,400	.88
50,000	50,000	1.00
40,000	45,200	1.13
30,000	33,000	1.10
25,000	27,000	1.08
$450,000	$408,600	$\bar{X}_R = .97$

$$\bar{X}_{AR} = \frac{\$408,600}{\$450,000} = .91$$

$$\text{P.R.D.} = \frac{\bar{X}_R}{X_{AR}} = \frac{.97}{.91} = \underline{1.07}$$

(Greater than 1.00 means the system is overpricing lower priced properties)

The Price Related Differential is useful that it may be easily programmed into the analytical portion of a system and provide specific data concerning assessment equity. The assessor may find that his system is discriminating against older or newer homes by viewing the P.R.D. long before this discrimination might otherwise have been noticeable.

Any valuation system which produces a list of values and a tax roll will continue to perpetuate any inequities inadvertently built-in to the system. If a system has been devised for checking key points such as a complete market analysis-module, the overall system may be corrected and continue to operate without major overhaul or revaluation. Continuous market analysis and appropriate adjustments will provide continuing maintenance of the assessment system, thereby virtually eliminating the need to ever have another complete equalization program.

C. Specific Tasks for Performance Analysis

Given the above mentioned statistical tests, there are a number of tasks which must be accomplished before implementation can be completed:

1. Formation of Analytic Unit.
2. Generation of statistical reports for Performance Analysis.
3. Actions indicated by reports.

1. Formation of Analytic Unit

A team of personnel must be assigned to analyze the statistical reports generated by the system. These personnel should be trained to interpret both statistical and appraisal data.

This Analytic Unit will also analyze all statistical reports generated by the entire appraisal system. These will include reports relating to costs, income data, multiple regression analysis, development of neighborhood factors, etc.

2. <u>Generation of Statistical Reports for Performance Analysis</u>

There are five statistical reports which will be generated by the performance analysis system. These provide applications of assessment-sales ratio data to various portions of the overall system. These reports are:

a. Ratio Calculation

b. Ratio Analysis for City of Boston - Aggregate Report

c. Ratio Analysis by Location (Neighborhood)

d. Ratio Analysis by Property Type

e. Ratio Analysis by Grade for Residential & Commercial

The contents, format, and reasons for including these reports in the system are detailed below.

a. <u>Ratio Calculation</u>:

This section will simply involve the calculation of sales-assessment ratios on all properties which have been sold. It is from this initial calculation that the next four steps of the system will follow. It is vital at this point to distinguish between sales which are representative of market value (bona fide sales) and those transactions which may or may not reflect the actual market value. Some of the reasons for rejecting a sale as not being bona fide are:

1. The sale was a foreclosure. Foreclosures will frequently result in sales prices below that of a property on the open market because of the desire to sell rapidly.

2. Parties in the sale were related to each other. Relatives, depending on the closeness of the family, may buy, sell or trade property among themselves for less (possibly more) than they would to anyone outside the family.

3. The sale was a liquidation for estate tax purposes. Any liquidation sale may result in a sales price not equal to market value due to the desire to sell and finalize the estate proceedings.

4. The sale was between related corporations. Because of income tax advantages gained from property trades, such as tax-free exchanges, etc., any intra-company sales should be automatically deleted.

5. The sale had unusual financial terms. Market value is a typical value which results from typical conditions in the market place. When financial demands on a property are greater than typical (an interest rate higher than normal or an amortization time shorter than normal), the net returns are thereby reduced, and sales prices are lower than market values would indicate on comparable properties.

6. The sales price was not current. Real estate values fluctuate from year to year therefore sales more than two or three years old should be deleted. If market analysis is an ongoing part of a system this condition will be self-correcting.

7. Unusual consideration existed. Property trades or exchanges will usually have considerations in addition to the physical real estate. Income tax advantages may warrant a considerable variation between two purchasers for the same piece of property.

8. Mortgage assumed was not noted. Assumptions of mortgages in a transfer should be noted. It is not common for one to list a "sales price" from deed information and overlook the existence of a mortgage assumption. The sales price is made up of all the consideration given, including any mortgage assumption which might have been made.

It should be noted at this point that the above items are not all-inclusive as indicators of a sale which should be deleted from analysis. They are, however, generally accepted as reasons why the market price, (i.e. the sales price) may be different from the market value of a property that has been sold.

Market Price is defined as the amount actually paid, or to be paid for a property in a particular transaction. Market Price differs from market value in that it is an accomplished historic fact, whereas market value is, and remains, an estimate until proved. Market Price involves no assumptions of prudent conduct by the parties, absence of undue stimulus or of any other condition basic to the market value concept.

Market Value, however, is defined as "The highest price in terms of money which a property will bring in a competitive and open market under all conditions requisite to a fair sale; the buyer and seller, each acting prudently, knowledgably and assuming the price is not affected by undue stimulus." Implicit in this definition is the consumation of a sale as of a specified date, and the passing of title from seller to buyer under conditions whereby:

1. Buyer and seller are typically motivated.
2. Both parties are well informed or well advised, and each acting in what he considers his own best interest.
3. A reasonable time is allowed for exposure in the open market.
4. Payment is made in cash or its equivalent.
5. Financing, if any, is on terms generally available in the community at the specified date and typical for the property type in its locale.
6. The price represents a normal consideration for the property sold, unaffected by special financing and amounts and/or terms, services, fees, costs or credits incurred in financing.

If the sales are not sufficiently qualified and verified, the resulting ratios will be virtually useless as indicators of the performance of the valuation system.

b. Ratio Analysis for City of Boston-Aggregage Report

This report will be generated for the purpose of calculating the aggregate ratio for all property types and locations throughout the city. For analytical purposes, this report will be less significant than subsequent ones. It will, however, have the advantage of allowing the analyst to compare city-wide statistics with the stratified statistics which will follow. The statistics to be provided are shown by name since definitions and deviations were explained earlier in this report. The format and statistics provided are:

City Wide

- Range
- $\bar{X}_r$ = mean ratio
- $\bar{X}_{mr}$ = median ratio
- $\bar{X}_{md}$ = mean deviation
- C.O.D. = Coefficient of Dispersion
- Var. = Variance
- S.D. = Standard Deviation
- 68% CI = 68% Confidence Interval
- 95% CI = 95% Confidence Interval
- C.O.V. = Coefficient of Variation
- P.R.D. = Price Related Differential

Given the data provided by this report, the analyst will be able to make general assumptions concerning assessment equity, ranges of ratios city-wide, and whether or not the system is biased towards higher or lower priced properties.

c. <u>Ratio Analysis by Location (Neighborhood)</u>

This report stratifies properties into predetermined neighborhoods. The statistics below are calculated for each of the neighborhoods so that each area may be analyzed separately for purposes of evaluating the performance of the system. This will involve arraying the data, by neighborhood (N_1, N_2, N_3,...N_n) and calculating as follows:

	N_1	N_2	N_3.....	N_n
Range.....				
$\bar{X}_r$........				
$\bar{X}_{mr}$.......				
$\bar{X}_{md}$.......				
C.O.D.....				
Var.......				
S.D.......				
68%CI.....				
95%CI.....				
C.O.V.....				
P.R.D.....				

Once the statistics have been calculated and formated, as above, the mean ratios ($\bar{X}_R$) and median ratios from all neighborhoods will be arrayed for the purpose of analyzing the assessment uniformity among neighborhoods. If disparities do not exist within neighborhoods, they may be found to exist between neighborhoods. These inter-neighborhood disparities may, perhaps, be easily explained, but without this step they never would be noted. For example, complaints are registered by two property owners owning similar properties in two different neighborhoods, who have received divergent assessments. This analysis, along with the stratified one can serve to assure both the taxpayer and the assessor that equity can be present within a neighborhood while different neighborhoods may provide differing values, due to location. The assessor may also desire "flag" points, where any difference between two neighborhoods greater than a given percentage will not be tolerated, especially if neighborhoods are similar.

Another advantage in viewing the composite of this report is that neighborhoods without sales may be analyzed on the basis of statistics generated by comparable neighborhoods with adequate sales data. The format of this intra-neighborhood report (using means and medians of all neighborhoods) is as follows ("N" = neighborhood statistic):

	Assessment Uniformity/ Neighborhoods ($\bar{X}_r$)	Assessment Uniformity/ Neighborhoods($\bar{X}_{mr}$)
N-Range....		
N-($\bar{X}_r$).....		
N-($\bar{X}_{mr}$)....		
N-($\bar{X}_{md}$)....		
N-C.O.D....		
N-Var......		
N-S.D......		
N-68% CI...		
N-95% CI...		
N-C.O.V....		
N-P.R.D....		

The last report generated within this section is a frequency distribution, by neighborhood. Five percent (5%) intervals are used for example purposes from 0% - 150+%.

	N_1	N_2	N_3.........	N_n
0 - 4.99%				
5 - 9.99%				
10 - 14.99%				
135 - 139.99%				
140 - 144.99%				
145 - 149.99%				
150 - + %				

d. Ratio Analysis by Property Type

The first step in this section is to stratify all ratios by property type. They may then be analyzed in terms of the statistics shown below. The assessor will have the capability of viewing the mean ratio, C.O.D. Confidence Intervals, etc. for a specific property type to insure that the system is valuing that property type properly. The initial report will be a frequency distribution.

	R1	R2	R3	R4	RC	CO	C	D	I	L
0 - 4.99%										
5 - 9.99%										
10 - 14.99%										
135 - 139.99%										
140 - 144.99%										
145 - 149.99%										
150 - + %										

The frequency distribution provides a good overview of the distribution of ratios both by individual type and for comparative purposes.

The next step in this report is to calculate the reporting statistics for each of the property types listed below.

R1 - One Family
R2 - Two Family
R3 - Three Family
R4 - Apartments
CO - Condominiums
RC - Mixed Residential/Commercial
C - Commercial
D - Dormitory
I - Industiral
L - Land

The format for stratification of these types and calculating the measures of assessment uniformity is as follows:

"PT" refers to property type.

	PT1 (R1)	PT2 (R2)	PT3 R3	PT4 R4	PT5 RC	PT6 CO	PT7 C	PT8 D	PT9 I	PT10 L
Range....										
$\bar{X}_r$.......										
$\bar{X}_{mr}$......										
$\bar{X}_{md}$......										
C.O.D....										
Var......										
S.D......										
68% CI...										
95% CI...										
C.O.V....										
P.R.D....										

Once the reporting statistics have been calculated for each property type the next step is to observe the assessment uniformity between property types ("PT"). This is accomplished by calculating statistics on the means and medians of each individual property type. This gives an indication of assessment equality for each property type. The next step will be to determine whether or not there is equity between apartments, single family homes, commercial property, etc. It is anticipated that there would be divergencies because of the inherent differences between property types. This step will serve to illustrate and perhaps explain some of these differences. The reporting statistics are as follows:

	Assessment Uniformity Property Type $\bar{X}_r$'s	Assessment Uniformity Property Type $\bar{X}_{mr}$'s
PT - Range....		
PT - $\bar{X}_r$.......		
PT - $\bar{X}_{mr}$......		
PT - $\bar{X}_{md}$......		
PT - C.O.D....		
PT - Var......		
PT - S.D......		
PT - 68% CI...		
PT - 95% CI...		
PT - C.O.V....		
PT - P.R.D....		

e. <u>Ratio Analysis By Grade (Quality Class) for Residential (R1) and Commercial (C) Property</u>

Residential and commercial properties will be graded according to quality class guidelines. These properties will be analyzed by each property grade to insure that assessment equity is being maintained among and between the property types listed below:

Residential	Commercial/Industrial
Low Quality.........	Class A.....
Fair Quality........	Class B.....
Average Quality.....	Class C.....
Good Quality........	Class D.....
Very Good Quality...	

The first step in the analysis by grade is to provide a frequency distribution to observe the flow of ratios for each grade of residential and commercial properties.

	Residential					Commercial/Industrial			
	Low	Fair	Average	Good	Very Good	Class A	Class B	Class C	Class D
0 - 4.99%									
5 - 9.99%									
10 - 14.99%									
135 - 139.99%									
140 - 144.99%									
145 - 149.99%									
150 - + %									

The reporting statistics for measuring the uniformity for the various classes of property are to be presented as follows:

	Residential					Commercial/Industrial			
	Low	Fair	Average	Good	Very Good	Class A	Class B	Class C	Class D
Range....									
$\bar{X}_r$.......									
$\bar{X}_{mr}$......									
$\bar{X}_{md}$......									
C.O.D....									
Var......									
S.D......									
68% CI...									
95% CI...									
C.O.V....									
P.R.D....									

These will allow the analyst to judge the effectiveness of the system, individually, for the different grades of houses and commercial structures. It is possible that a system might value average grade homes very well but over-value low-priced structures and/or under-value higher-priced structures. This portion of the performance analysis will allow the analyst to view the system most conveniently for this purpose. The next step in analyzing property types is to use the reporting statistics to determine the means and medians of all residential and commercial property separately.

	Assessment Uniformity Residential	Assessment Uniformity Commercial
PG* - Range....		
PG - $\bar{X}_r$.......		
PG - $\bar{X}_{mr}$......		
PG - $\bar{X}_{md}$......		
PG - C.O.D....		
PG - Var......		
PG - S.D......		
PG - 68% CI...		
PG - 95% CI...		
PG - P.R.D....		

*The term "PG" means Property Grade.

This section presents the last of the performance analysis reports. By utilizing these analytical reports, one can test a system for purposes of viewing the assessment equity at virtually every level of stratification.

Retrieval of data for analytical purposes will be all inclusive. For example, the analyst wishes to view the equity for grade "very good" homes located in neighborhood #7. This information might be necessary as supplemental data to support an appraisal in an abatement proceding or in performing periodic maintenance checks on the valuation system. The following would be a method of viewing data necessary to analyze "Very Good" grade homes in Neighborhood #7.

	City Wide	N7	$N\bar{X}_r$	R1	$PT\bar{X}_r$	Very Good	$PG\bar{X}_r$
Range....							
$\bar{X}_r$.......							
$\bar{X}_{mr}$......							
$\bar{X}_{md}$......							
C.O.D....							
Var......							
S.D......							
68% CI...							
95% CI...							
C.O.V....							
P.R.D....							

This would first provide data about the city, then comparative data on the specific neighborhood involved. It would then examine all neighborhoods rather than just neighborhood #7. Next, single family residential properties are observed and compared to other property types. The property may be analyzed in terms of its grade and then compared to all grades. The analyst will have the opportunity to statistically look at the entire city, the specific neighborhood in question, the specific property in question and the specific property grade in question.

3. Actions Indicated by Reports

Possible actions indicated by any one given statistical report are numerous. Those covered within this section are not intended to be exhaustive in nature, but are intended to provide a general idea of anticipated responses to the five reports covered in the prior section. The actions are shown below for each respective report.

a. Action on Ratio Calculation

The ratio calculations report is simply a listing of sales within the City. There are no statistics produced with this report. The data are arrayed and a frequency distribution is produced. The analyst may, at this point, get an overall view of the range and general distribution of ratios, and therefore, valuations.

Specific actions would be limited to observations of excessive numbers of ratios below the desired assessment level without any indications of possible solutions to the problem.

b. Action on Ratio Analysis - Aggragate Report

Using this report, the analyst, can make some specific assumptions about the system. However, these statistics are city-wide, thus any assumptions made should recognize that no stratification has occurred.

While the analyst uses all of the statistical data provided, actions would be based on those key statistics which specifically indicate the level of equity within specific portions of the system. The following two statistics are considered action oriented. The remainder assist in interpreting the degree of equity or inequity indicated by these two:

1. Coefficient of Dispersion
2. Price Related Differential.

1: The Coefficient of Dispersion should be less than 20.00. If the aggregate report indicates an overall C.O.D. of 20 or higher, the analyst should then view additional reports to determine the cause and then make recommendations for correcting the system.

2: The Price Related Differential on a city-wide basis will not be particularly significant. When it varies from 1.00 in either direction (positive or negative) more than 2 points, remedial action should be considered.

c. Action on Location/Neighborhood Report

This report will provide data at the level of stratafication where specific action may be taken.

1. Coefficient of Dispersion: If the C.O.D., on any given neighborhood is greater than 19.99, the analyst should immediately notify the appraisal department. The market adjustment factor for that area should be checked for accuracy. The specific properties which contained the highest (or lowest) ratios should be reviewed, first by property record card and next by an actual field visit.

2. Price Related Differential: If the P.R.D. is less than 98.00 or greater than 1.02, the valuation schedule for the suspect property type should be reviewed for other nearby neighborhoods. A P.R.D. greater than 1.00 indicates an overvaluing of low priced properties in relation to higher priced ones. A P.R.D. less than 1.00 indicates the system is overvaluing higher priced properties. When the P.R.D. exceeds the limits of .98-1.02 within a specific neighborhood, it is likely that the system is over-or under-valuing a specific component of the properties, or that a mistake was made during the data collection in that neighborhood.

d. Action on Ratio Analysis by Property Type

This report is also on a level where specific action may be taken on the basis of statistics provided.

1. Coefficient of Dispersion: If the C.O.D. for a given property type is greater than 19.99, the analyst should notify the appraisal department. The specific property type should be "re-run" by neighborhood to see if there is any locational problem which may not have shown up in the overall location report. The C.O.D. for the specific property type in question should also be checked against the C.O.D. calculated on the mean ($\bar{X}$) and median ($\bar{X}_n$) for all property types.

Possible solutions to problems not found through statistical analysis may be located by reviewing the valuation procedures for that property type. The property records for specific properties involved in the study (ones resulting in high or low ratios) should be studied for data collection errors. The final step would be to physically revisit properties to see if data were correctly recorded.

2. Price Related Differential: If the P.R.D. for a given property type is outside of the 98 to 1.02 limits, there is a serious problem with either the valuation system or the data collected. It is likely that the problem will be within the system. When the P.R.D. for a given type is outside the limits, the valuation system should be reviewed.

Since the path of least resistance is sometimes easier to follow, it is a good policy to always review statistics and property records first. Then conduct initial studies of the system and conduct field checks before entering into a complete analysis of the valuation procedures.

e. Action on Ratio Analysis by Grade (Classification)

The statistics provided by stratification by grade are particularly significant because the data are provided for properties which are very similar to each other.

1. Coefficient of Dispersion: When the C.O.D. is greater than 19.99 for properties within the same grade, it is likely the problem is one of data collection. Since the system values properties of the same class from the same base value units, variations in valuations should be due the incorrect input of data on data collection errors.

2. Price Related Differential: When the P.R.D. for grade stratification is outside the .98-1.02 limits, the analyst should view both the data collected and the system. Normally, there should not be much variation within a given property class because similarly priced homes will be grouped together. Problems encountered within that particular stratification may be more serious in terms of implications towards a complete review of valuation procedures for that group.

CHAPTER TWO - DATA BASE DESIGN

1. Introduction

The effectiveness of a mass equalization system is totally dependent upon a complete and accurate data base which reflects the value influencing characteristics of each and every parcel of property in the City of Boston. Such a data base is required to develop estimated values utilizing the three approaches to value, to generate assessment rolls based on these values, and to create and maintain appropriate records on all the individual properties in the city.

At the present time, a data base of this nature is virtually non existent. Consequently, property within the city will have to be inventoried and value influencing characteristics will have to be identified for each parcel. Initially, this process may take place through deed research, mapping, analysis and utilization of Building Department records, the present real estate file of the Assessing Department, the tax exempt file, and the tax billing system.

For purposes of this report, the real estate data base may be divided into two types of information. The first type is called ownership information, as it primarily consists of legal data. The second type is specific property information relating to the value influencing characteristics of each parcel.

The ownership information is utilized currently in the city's tax billing system. This portion of the data base will interface with the new system upon implementation.

As mentioned above, there is no systematic organization of the value influencing characteristics of property in Boston. Therefore, these data elements must be captured in some fashion. This data capture will involve analysis of current property information on file in various city departments (i.e., Assessing Department, Building Department, etc.) and through a property visitation program.

In this Section, the data requirements will be described, and the collection, storage, and maintenance procedures for a real estate data base for the City of Boston will be outlined.

A complete description of the role of the data base in the total equalization process is contained in Chapter IV of this Report.

The data requirements for the City of Boston are presented in three subheadings describing a total of 105 data base elements needed to effectively utilize the three established approaches to valuation. These subheadings are:

1. Data Base Requirements, Residential Property
2. Data Base Requirements, Commercial Property
3. Data Base Requirements, Sales Analysis File

2. Data Base Requirements, Residential Properties

In order to maintain appropriate records, produce annual tax bills, and to process estimated values by the three approaches, it will be necessary to collect and maintain a data base on all individual properties located in the City of Boston. The Residential Data Base has been subcategorized as follows:

A. Property Identification Characteristics - Name, Address, and Legal Information, (Historic Data)
B. Physical Characteristics (Specific Data Elements)
C. General Value Influencing Factors (General Data Elements)

The following list is furnished for the purpose of identifying and defining data base elements. Field operations for gathering these elements will be discussed following this sub-section.

A. Name, Address, and Legal Information (Historic Data)

1. Unique Parcel Identification Number: The unique parcel identifier contains reference to those items which will separate the parcel from all other parcels, allowing it an "identity" of its own. This number will contain the Ward #, the District #, the Map #, the Block #, the Lot #, and the Sub-Lot #, (if applicable). One can, therefore, locate and separate a single parcel of real estate by knowing the parcel number. This unique numbering system, when used interdepartmentally, can serve as a reference and cross-reference any time there is need to refer to a given parcel of real estate. The same numbering system may be used by the Registry of Deeds, The Building Department, the Engineering Department of the Assessing Department, the B.R.A., the Public Works Department and any other department which has or needs access to property through some means of parcel identification.

2. Map, Block, and Lot Number: This number references the property tax map system for the City of Boston. The tax map number is also unique and may be used for parcel identification and for retrieval purposes. This number may take the form of the property tax map system currently in operation for the City of Boston. In the event of a re-mapping program, the tax map number will be reformatted in a manner that will facilitate a more sophisticated management control program. Due to the fact that a re-mapping decision has not been made as of this date, the existing map number will be described followed by a proposed map number as may exist in a new mapping system.

Existing Mapping System

Map #:

The map # refers to the number assigned to a specific aerial photograph or planimetric map. This number is unique and a part of the identification system for a particular parcel of real estate. The Map # for any parcel of real estate provides an identifier for the general area surrounding the parcel. Map #'s are assigned by the Engineering Department and may be found on the Deed Abstract Form after the Engineering Department has completed action on it.

Block #:

The Block # is a "subset" of the Map #. Each map is divided into "Blocks", which usually follow street defined blocks on the map. A "Block" may contain several physical city blocks or may only contain one. The number depends on the size and number of "Lots" contained within the block. The Block # is also part of the unique parcel identification system and may be found on the Deed Abstract Form or on the aerial photos or planimetric maps.

Lot #:

The Lot # is a subset of the Block. The Lot # refers to a specific lot within a given, stated Block and is a single parcel of real estate. The Lot # is, unless the parcel is subsequently subdivided, the unique number that refers to one specific parcel of real estate. Lot #'s are assigned by the Engineering Department and may be found on the aerial photos, the planimetric maps, the Deed Abstract Forms or the Property Record Cards.

Sub-Lot #:

The Sub-Lot # is the same as the Lot # described above except that it only occurs when a "Lot" has been subdivided or "Split". When a Lot, which already has a unique identifier, is subdivided or split, a number must be generated for the new parcel which has been created. This new number is called the "sub-lot #". It is assigned by the Engineering Department and may be found on the aerial photos, the planimeter maps, the Deed Abstract Forms or the Property Record Cards.

Proposed Mapping System

Property Parcel Numbering Example: One type of parcel number consists of three (3) basic parts: the sheet number, the block number, and the lot number. The sheet numbering system has been previously described. This number will consist of five (5) digits. A whole number will indicate that the sheet is mapped at 1"=100' and a decimal number will indicate the sheet is mapped at 1"=50'.

The block numbers can be up to two (2) digits in length. Each sheet can be subdivided into blocks that would contain less than 100 parcels. Blocks are numbered consecutively on each map starting in the northwest corner with 1. Blocks can be formed using natural boundaries such as roads, highways, rivers, railroads, etc. Condominium buildings will constitute an individual block and would be identified by an Alfa Character. Example A-2

The lot numbers will consist of maximum of two (2) digits. Lots are numbered consecutively from 1 within each block. The numbering should begin in the upper left portion of the block and continue in a clockwise direction around the entire block.

Examples: Parcel on 1"=100' Map 36.00-03-02
Parcel on 1"- 50' Map 36.02-03-02

Parcels Falling on More Than One Map: Where it is necessary to show portions of a single large parcel on two or more map sheets, the parcel and its match lines will be clearly labeled on each map sheet, together with a note as to where the remainder of the parcel appears. The parcel acreage and number will appear on the map containing the greatest area.

Parcel Subdivision: When a part of a parcel is sold, a decimal suffix is added to the original parcel number for both the original part of the parcel and the new parcel. The parcel retained is always numbered with the suffix 1, while the sold portion(s) are suffixed starting with the number 2 and numbering up. After the maximum number of digits is reached in the parcel number, the split parcel will have to be numbered using the next higher number in the block of the block will have to be renumbered.

Example:	06.01-02-03	Original Parcel
	06.01-02-03.1	Retained Portion
	06.01-02-03.2	Portion Sold
	If One of These Is Split	
	06.01-02-03.2	Original Parcel
	06.01-02-03.21	Retained Portion
	06-01-02-03.22	Portion Sold

3. Property Address: The property address refers to the physical street address. This is synonymous with the "mailing address" of a property. The property address is a necessary element of the data base because it is where all correspondence concerning the property is sent if the property is occupied by the owner. The property address may be found as a cross-reference with the parcel identifier; it may be found on the property record cards; or it may be found in a listing of the tax roll by either parcel identifier or address.

4. Coordinate Locator Number: A coordinator locator number will be assigned to every parcel of land. The coordinate locator will be a combination of the easting and northing coordinates in the Massachusetts State Plan Coordinate System. It will locate the approximate visual center of each parcel. The easting reading of (7) digits will precede the northing reading of (6) digits.

   Example: 2572507 - 459106

   This information will be furnished along with the parcel index. The parcel index is a cross reference and lists the new parcel number, the old parcel number, the coordinate locator number, and the data control number.

5. Data Processing Number: The new master real estate file will require a property identification number for each parcel as was defined under Item 3. Since the existing real estate file does not utilize such a number and the old file is to be embedded into the new system, existing data processing numbers must be retained and cross referenced with the parcel identification number.

6. <u>Ward Number</u>: There are 22 wards within the City of Boston. The Ward Number is an essential portion of the unique parcel identification system for a property. The Ward Number is assigned by the Engineering Department and may be found on the Deed Abstract Form.

7. <u>Neighborhood Code</u>: The neighborhood code is assigned for the purpose of identifying "neighborhoods" much as the parcel identifier uniquely identifies a parcel. Neighborhood codes are necessary in order to allow valuation systems to delineate and assign (if appropriate) certain factors which will reflect differences or "value influences" within different neighborhoods. A "neighborhood" is defined as "a portion of a larger community, or an entire community, in which there is a homogenous grouping of inhabitants, buildings, or business enterprises. . . Neighborhood boundaries may be well-defined by a distinct change in land use or in the character of the inhabitants". The neighborhood code is an unique number which sets a specific area apart from the rest of the surrounding property due to the above stated reasons.

8. <u>Year Built</u>: This data item refers to the actual year that the improvement was completed. The year built is determined by the field appraiser or through the building permit system. It is used as a guide in the estimation of the accrued depreciation on the improvements. Year built is also used when delineating between general periods of construction (i.e., before 1920, 1920-1940, 1940 to present).

9. <u>Building Permits</u>: A building permit is an application for new construction, alterations to existing construction or demolition of existing construction. The City of Boston has an extensive, progressive building permit system. The input of building permit information into a system provides an excellent source of data where field personnel need to concentrate their updating and maintenance activities. The common denominator between the permit system and the appraisal system is the unique property identification number which should be utilized by both departments. The information which should be shared in the system is the date of the permit, the name and address of the applicant and the property permit number, and the percent (%) complete.

10. Lot - Zoning Data: Several items are collected and stored under this category. Lot Area is the total square footage contained within the property boundaries. The Lot Area computation should come from the Mapping Department. Width and Depth should reflect a standard "lot size". Within each neighborhood and for the various property types, there is a well defined standard lot size. This standard size may provide for a range of acceptable frontages, depths, or square footages before additional adjustment is required. The purpose of having a standard lot size is to enable the system to accommodate lots which are unusual in size or shape. If a lot does not conform to the "standard", the system will, depending upon the input information gathered by the field appraiser, make the necessary adjustments to the lot to insure uniformity. The adjustments will be made on the basis of Access Area. Access Area should be recorded reflecting the difference between actual lot area and standard lot size. The appropriate zoning code will be input into the system by the user. The purpose is so the field appraiser will have available to him the zoning of various areas for purposes of making valuation decisions. Zoning is an important component in the valuation of land because it may restrict the use of the land. Land use restrictions may enhance or hinder the attractiveness of land for potential investors, thereby limiting the available market for real estate. Multi-zoning alerts the appraiser's attention to the fact that the property is controlled by more than one zoning type. This indicator is for indentification and valuation purposes only. For valuation purposes, the appraiser must consult backup information not contained in this data base.

B. Physical Characteristics (Specific Data)

11. Grade: The grade of the improvement refers to the "quality" of construction; quality of materials; the quality of workmanship observing such items as the foundation, floor structure, exterior walls, roof, interior finish, heating and cooling systems, and other items where workmanship and materials may have resulted in a higher or lower quality house. The quality of construction will be related to the cost of construction which will determine the eventual market value of the improvements. Various Grades are Low Quality, Fair Quality, Average Quality, Good Quality, or Very Good Quality.

Percent (%) Grade: The percent (%) grade is used when the field appraiser finds it difficult to assign a specific grade to a property which seems to fall in between two distinct grades. Allowing for a percent (%) grade provides more flexibility within a system which is constantly interrelating cost data and market sales for co-verification of data inputs. Percents may be assigned in increments of 5% or they may be allowed for any percentage estimated by the field appraiser to the basic grade initially assigned (i.e., "Fair Quality + 50%).

12. Condition: Condition is somewhat synonymous with effective age. Both factors combine in the system to reference a stored table file for the calculation of accrued physical deterioration. The condition factor is coded as to general category, such as substandard, fair, average, good, or very good. A curvilinear relationship is developed between the condition factor and the effective age to generate the actual amount of depreciation calculated as a result of input in these two elements (effective age and condition). Care should be taken by the appraiser not to confuse the condition entry with the entry previously described as Grade. For example, a forty (40) year old low grade residence can have a very good condition if the owners maintenance program sets this property above what is typical for the neighborhood.

13. Effective Age: "As applied to a structure, the age of a similar structure of equivalent utility, condition, and remaining life expectancy as distinct from chronological age; the years of age indicated by the condition and utility of the structure. If a building has had better than average maintenance, its effective age may be less than the actual age; if there has been inadequate maintenance; it may be greater. A 40 year old building may have an effective age of 20 years due to rehabilitation or modernization."

    Effective age is used to access depreciation tables stored in the table file. The depreciation table is in terms of percent good and expresses the amount of physical deterioration attributable to the improvements.

14. Functional Obsolescence: ". . . .reflects the loss in value brought about by such factors as overcapacity, inadequacy, and changes in the art, that affects the property item itself or its relation with other items comprising a larger property. The inability of a structure to perform adequately the function for which it is currently employed." Functional obsolescence is estimated by the field appraiser or is documented by actual market sales data. In either instance, the input for this element would be in the form of a percentage of replacement cost. It is possible to input a lump sum dollar amount for functional obsolescence if that amount can be somehow documented as the "cost to cure" a deficiency in the property.

15. Locational Obsolescence: "That loss in value experienced by a structure as a result of negative environmental forces outside the boundaries of the property. It is also known as environmental obsolescence or economic obsolescence." As with functional obsolescence, locational obsolescence is an estimate by the field appraiser based on comparable sales data or resales within an area. Lump sums or percentages may be used depending on the documentation required and on the parameters of the system involved. Locational obsolescence represents a loss of value which is reflected as a deduction from the replacement cost new of the structure.

16. Architectural Design: This entry refers to configuration design by type and style. It is a general category section and will be used to key the proper cost table file. Although several specific design types could fit into one or more general categories, the appraiser should select the most appropriate category that describes the property under appraisal.

17. Construction Type: This structure code refers to the basic type of construction for the improvement(s). These are noted in the field by the appraiser and entered on a property record card. General categories for various types of construction include wood frame, masonry brick or masonry concrete block. The construction codes are a necessary component in the initial identification of the general construction for costing purposes. The structure code becomes a part of the master file on every improved property.

18. Exterior Walls: Exterior Walls are another element of structural type denoting wall construction or wall covering. Various types of exterior walls are stucco, siding/shingle, brick veneer, common brick, face brick/ stone, or concrete block. Like construction type, the exterior wall element is a necessary component for general construction costing purposes.

19. Story Height: Story height refers to the number of stories in a given improvement. Examples are one story, one and one-half story, one and three-quarters story, two story, through four stories. In determining story height, it should be noted that one-half story indicates living area in an amount equal to at least 50% of the base area. Three-quarters story indicates living area in an amount equal to 50% - 80% of the base area, and it is usually accomplished by extensive use of dormers or a raised roof design. Cost tables make allowances for different combinations of story heights.

20. Square Feet: The number of square feet of living area determine the number of square feet utilized by various portions within the structure and the costing portion of the system. The living area refers to the heating portion of the structure when measuring around the perimeter of the improvement. A two story section of the improvement would, by the measure just described contain two times the area in the same base size one story improvement. The reason for exterior measurements is that the square foot cost utilized include the exterior walls and basic construction (i.e., framing, installation, interior walls, etc.). The square feet of living area are applied to the appropriate square foot rate to arrive at a base building value.

21. Perimeter: The perimeter refers to the total length of the periphery of a given area, e.g., the distance around the outside of a building. Perimeter measurements are in "lineal feet" measuring the distance around the building at ground level. The total perimeter should not include carports, attached garages, or any type of porch. Square foot costs do not always accurately portray size and costs. For example, both a 10' x 40' and a 20' x 20' building have 400 square feet. The first, however, has a

perimeter of 100 lineal feet while the second has a perimeter of 80 lineal feet. The first building would cost more to build because of the building materials required for the extra 20 lineal feet of exterior wall. The perimeter is noted at the same time as the measurement for square footage.

22. Total Living Area: Total Living Area as referred to in this category is the sum total of all sectioned living areas as may be recorded under Item 20.

23. Roof Types: Roof types refer to the name of the particular type of roof construction. Examples are Mansard, Gambrel, Flat, Gable, Hip, or other. This item is retained for informational purposes only, and will not key into the costing program. Elaborate roof designs that will have a direct effect on cost should be reflected as a plus percentage in the improvement grade. (See Item 11)

24. Roofing: Roof construction refers to the material used in the construction of the roof. As in Item 22, this category is for informational purposes and cost differentials should be reflected in the improvement grade. Examples are asphalt shingle, tile, wood shingle, slate, built-up rock and tar, etc.

25. Foundation: "That upon which anything is built; that part of a structure upon which the building is erected; usually that part of a building which is below the surface of the ground and on which the superstructure rests." The type of foundation material is what is noted at this point by the field reviewer. Various types are concrete, concrete slab, concrete block stone. This Item is also for informational purposes, and cost differentials will be reflected in improvement grade.

26. Floor Construction: This input Item denotes floor support construction and involves an inspection from the basement or crawl to determine the type (either wood or concrete).

27. Floor Finish: The finish over the sub-floor construction can be of several types and should be noted. These Items can be multi-entry and are for informational purposes only with no reflection on cost procedures. Categories listed are soft wood, hardwood, vinyl/linoleum, or carpet.

28. Plumbing: The number of bathrooms, lavatories and the number of extra fixtures are input for this item. Baths are considered to be three fixtures and lavatory two fixtures. Extra fixtures are entered by the total number.

29. Heating: This data element refers to residential heating types. Types utilized are: forced air, gravity, radiator, floor furnace, radient, baseboard, wall unit, heat pump or none. These Items will be noted by the field appraiser and become a part of the property record card information. The Items will be entered for comparison with the appropriate table file within the system for valuation purposes.

30. Air Conditioning: This Item is a yes or no entry and implies the presence of an air conditioning system as a built-in part of the improvement.

31. Energy Source: This Item relates to the energy source for the heating system (of which the air conditioning may be a part). Types are electricity, gas, oil, coal, or solar.

32. Basement: Basement is generally part or all subterranean, and where present, it is the lowest level of an improvement. It is characterized by standard ceiling heights under the first floor structure, poured concrete floors, and foundation type exterior walls. This entry is made by entering the square foot at which may be equal to the first floor area or any lesser amounts as represented by a partial basement.

33. Basement Finish: Basement finish refers to any part or all of the basement area that is finished like the living area. To qualify as finished living area, the basement should contain floor covering, wall covering, ceiling finish, and heating. This Item is entered as the total of square feet. It may be equal to all or part of total basement area. The system will index cost tables for the basement and basement finished areas.

34. Built-Ins: Items to be noted are not considered personal property but are built-in, in some fashion to the residential improvement. These items will include built-in stove, refrigerator, dishwasher, disposal, exhaust fan and hood, compactor, intercom systems, vacuum systems, and security systems. The system will handle these Items as "lump sums" in adjusting the valuation of the improvement.

35. Garages - Porches - Miscellaneous Improvements: Garages are to be coded as to whether they are attached, detached, or built-in. Garages will be given a grade which will reflect quality and type of construction. A condition factor, relating to the same categories of condition for the improvement, under Item 12, will also be entered for the Garage. Porches, like Garages, are entered in three categories of opened, covered, or enclosed, The appraiser enters up to three types, the square foot area, grade, and condition. The system will index a table file for valuation. Miscellaneous Improvements refer to any land improvement not previously discussed that will add value to the property. These Items may take the form of paving, fencing, etc. The Items are identified by the number of units which may represent square foot, linear foot, etc., and the appraiser's estimate of cost per unit. The system will calculate the total value for the miscellaneous improvements by multiplying the number of units entered by the price indicated. Prices entered for miscellaneous improvements should reflect the depreciated cost.

36. Improvement Sketch: The Improvement Sketch is a graphic illustration of the building perimeter depicting sections of the improvement where multi-story heights exist, and attached porches and garages. The Improvement Sketch will be collected on the site, and entered into the computer for storage and reproduction. Instructions for drafting the improvement will be given in detail under measuring and listing guidelines, and computer procedures will be discussed under System Design.

C. General Value Influencing Factors (General Data)

37. Locational Influences: Location, by definition, is "An economic characteristic of real estate composed of immobility, constant change, dependence, and elements of special distribution. Location is an economic concept, even though a location can be described in physical and legal terms". Once the locational factors are identified, the system will analyze and adjust for the market reaction to these factors through the multiple regression analysis routines. A more detailed discussion of this procedure may be found in the System Design Section of this Report. For purposes of data collection, emphasis is placed on collecting the locational influences in a manner that will record the presence of a factor in an objective fashion, ruling out any subjective opinions by the data collector. Therefore, each item will be identified, and the data collector will rate the item as below standard, standard, or above standard, relating to typical for the neighborhood or simply record the presence of terms as yes or no. By recording these factors in a "no opinion" approach, the system through regression analysis will then determine what, it any, affect the factor has on market value.

Locational conditions listed are: Street Condition, Sidewalks, Traffic, Neighborhood Condition, Water Front, Parks, View, Security, Shopping, Noise, Parking, Medical, Public Transportation Church, Historical, and Topography. Space has been allowed in the system for additional items.

38. Exceptions: A computerized equalization system for Mass Appraisal is most efficient when processing properties that are homogeneous in nature. To insure maximum homgeneity, the real estate base will be stratified by neighborhood and property types. However, for various reasons, certain properties which will not process through the system will

necessitate individual handling by trained appraisers. To identify these properties, exceptions are noted. When a property has been identified as an exception, the system will produce an edit list from which individual assignments may be made. The following exceptions are identified and should be noted when present in individual properties. Unique Property, Unfinished Value, Invalid Sale, Exempt Property, Rent Control, Restrictions. Additional space has been allowed in the System for recording additional exceptions as may be needed.

39. Remarks: Regardless of the completeness of a data base, situations will arise periodically that require appraiser's notations. The Remarks Section of the data base has been designed to allow for entry storage and reproduction of appraiser's notations. The appraiser or data collector should abbreviate and minimize notations. The System will simply pick up the abbreviated notation and reproduce the information on the Property Record Card.

2. Data Base Requirements, Commercial Properties

The Commercial Data Base consists of the following general categories of data elements:

A. Property Identification Characteristics - Name, Address, and Legal Information (Historic Data).
B. Physical Characteristics.
C. Income Property Data Elements.

These categories are enumerated below in terms of individual items which are within each broad category.

A. Name, Address, and Legal Information (Historic Data)

These data items 1-10 will be the same listed under paragraph A (a) of the previous section. These items, as defined earlier, are:

1. Unique Parcel Identification Number
2. Map, Block, and Lot Number
3. Property Address
4. Coordinate Locator Number
5. Data Processing Number
6. Ward Number
7. Neighborhood Code
8. Year Built
9. Building Permits
10. Zoning Data

11. Occupancy Codes: All improvements valued by the commercial system are assigned an "occupancy code". This code identifies the particular property type within the system. The occupancy codes are listed on the next page.

12. Grade: Within each Occupancy Code is a "Construction Classification Type". There are four types of classifications which may be assigned to commercial improvements:

    a - Class A Buildings
    b - Class B Buildings
    c - Class C Buildings
    d - Class D Buildings

    a. Class A Buildings:

    The primary feature of Class "A" buildings is a fireproofed structural steel frame, which may be welded, bolted, or riveted together. The fireproofing may be masonry, poured concrete, plaster, sprayed asbestos, or any other type which will give a high fire-resistant rating. Floors and roofs in Class A structures are normally reinforced on steel decking or formed slabs resting on the frame or poured so as to become integral with it. They may also be composed of prefabricated panels which may be mechanically stressed. Exterior walls will be curtain walls of masonry, concrete, steel studs, and stucco, or one of the many types of panels of metal, glass, concrete and other materials. Interior partitions will frequently be of masonry or gypsum block although many movable and light weight partitions are used. Included in this classification are Uniform Building Code construction Types I and II.

OCCUPANCY CODES

+300 Apartment
+301 Armory
302 Auditorium
303 Automobile Showroom
+304 Bank
384 Barber Shop
305 Barn
306 Bowling Alley
307 Cabin
308 Church with Sunday School
309 Church without Sunday School

+310 City Club
+311 Clubhouse
312 Coldwater Flat
+313 Convalescent Hospital
314 Country Club
315 Creamery & Milk Process
316 Dairy & Milking Barn
317 Dairy Sales Building
+318 Department Store
319 Discount Store
320 Dispensary
+321 Dormitory
322 Fire Station
323 Fraternal Building
+324 Fraternity House
+325 Garage, Service
+326 Garage, Storage
+327 Governmental Building
328 Hangar, Storage
329 Hangar, Maintenance & Office
+330 Home for the Elderly
+331 Hospital
+332 Hotel, Individual Baths
+333 Hotel, Common Baths
+334 Industrial, Manufacturing
+392 Industrial, Engineering
+335 Jail
336 Laundromat
+337 Library
+338 Loft
339 Lumber Storage, Horizontal
390 Lumber Storage, Vertical
340 Market
+341 Medical Office
+342 Mortuary
343 Motel
+344 Office Building

+345 Parking Structure
+388 Parking Structure Underground

+346 Post Office
347 Poultry House
+348 Rectory
349 Restaurant, Drive-in
+350 Restaurant, Table Service
351 Residence, Single Family
352 Residence, Multiple
+353 Retail Store
354 Row House

School, Elem. & Secondary
355 Arts & Crafts
356 Classroom
357 Commons
358 Gymnasium
359 Lecture Hall
360 Library
361 Manual Arts
362 Multi-Purpose
363 Physical Education
364 Science
365 Entire Elementary
366 Entire Secondary

School, College
367 Arts & Crafts
368 Classroom
369 Commons
370 Gymnasium
371 Lecture Hall
372 Library
373 Manual Arts
374 Multi-Purpose
375 Physical Education
376 Science
377 Entire College

385 Shed
378 Stable
389 Storage, Equipment
391 Storage, Material
379 Theater, Stage Presentation
380 Theater, Motion Picture
383 Tobacco Barn
+381 Veterinary Hospital
+382 Warehouse
386 Warehouse, Mini
387 Warehouse, Transit

+Occupancies for which elevator cost are provided on a square foot of total floor area basis.

b. Class B Buildings:

The primary characteristic of a Class "B" building is the reinforced concrete frame in which the columns and beams can be either formed or precasted concrete. They may be mechanically stressed.

Floors and roofs in Class B structures are formed or precast concrete slabs. The exterior walls will generally be masonry or any of the many types of wall panels or concrete, metal, glass, or stone. In some cases, in a Class B building, the walls may be partially load bearing. Interior partitions are often masonry or reinforced concrete, or gypsum block. Many lightweight and movable partitions are used where structural walls are not needed. Included in this classification are Uniform Building Code construction, Types I and II.

c. Class C Buildings:

Class C buildings are characterized by masonry or reinforced concrete (including tilt-up) construction. The walls may be load bearing, i.e., supporting roof and upper floor loads, or non-bearing with concrete, steel, or wood columns, bents or arches supporting the load. Floors and roofs are supported on wood or steel joists or truss' or the floor may be a concrete slab on the ground. Upper floors may be of concrete plank. Bearing walls are frequently strengthened by concrete bond beams and pilasters. In this classifications are included Uniform Building Code construction Types III, IIA, and IIB.

d. Class D Buildings:

Class D buildings are characterized by non-fireproof construction and wood or steel framed exterior walls. The exterior walls may be made up of closely spaced wood or steel studs, as in the case of a typical wood framed house, with an exterior covering of wood siding, shingles, stucco, brick, or stone veneer, or other materials. Otherwise they may consist of a skeleton wood, or open steel frame on which some form of sheet siding is applied, as in pre-engineered buildings. Class D is further used to include all buildings that do not fit into any other classification; however, special buildings such as service stations, greenhouses, etc., will be found in the special cost sections of a cost manual. Because of similarity in cost, Types IV and V under the Uniform Building Code are included.

13. Cost Rank (Commercial Data Base No. 13): The "Cost Rank" is utilized when entering individual items for valuation using a segregated cost method. It is a rating from 1 to 4. These represent a typical spread between low cost (1), and high cost (4) for any given component within an occupancy group. Ranks are:

Low Cost = 1

Average Cost = 2

Above Average Cost = 3

High Cost = 4

An example of how these are assigned is to view "Floor Covering" for apartments. For each type of floor covering (i.e., asphalt tile, carpet and pad, cork, hardwood, etc.), there are four costs given, depending on the appraiser's judgement as to the quality and cost of replacing that item.

3. Physical Characteristics

14. Total Floor Area: "Total horizontal surface of a specific floor or the total area of all floors in a multi-story building, computed from the outside building dimensions of each floor." Balcony and mezzanine floor areas are computed separately and added to the total floor area.

15. Perimeter: The total length of the periphery of a given building and equal to the distance around the outside of the building.

16. Number of Stories: The number of stories refers to the actual number of floors contained in a building. Basements are not included when determining the number of stories (i.e., one-story, two-story, three-story, etc.).

17. Story Height: Story height refers to the number of stories in a given improvement. Examples are one story, two story, ten-story, and twenty-story. The cost system is based on base story heights for various commercial buildings. Any variations from the base are handled by percentage adjustments (i.e., for apartment buildings, add .6% for each story over three above ground to all base costs).

18. Effective Age: "As applied to a structure, the age of a similar structure of equivalent utility, condition, and remaining life expectancy as distinct from chronological age; the years of age indicated by the condition and utility of the structure. If building has had better than average maintenance, its effective age may be less than the actual age; if there has been inadequate maintenance, it may be greater. A 40 year old building may have an effective age of 20 years due to rehabilitation or modernization."

19. Condition: Condition is somewhat synonymous with effective age. Both factors are combined in the system to reference a stored table file for the calculation of accrued physical deterioration. The condition factor is coded as to general category, such as substandard, fair, average, good, or very good. A curvilinear relationship is developed between the condition factor and the effective age to generate the actual amount of depreciation calculated as a result of input in these two elements (effective age and condition). Care should be taken by the appraiser not to confuse the condition entry with the entry previously described as Grade. For example, a forty (40) year old low grade residence can have a very good condition if the owner's maintenance program sets this property above what is typical for the neighborhood.

20. Exterior Wall: The Exterior Wall refers to the exterior covering of a building, either structural or facade. There are four basic types of exterior walls with subtypes with each as follows:

    a. Masonry Walls

        Adobe Block
        Brick, Block Back-up (Thick)
        Common (Thick)
        Cavity (Thick)
        Face Brick (Add)
        Concrete Block (Thick)
        Concrete, Reinforced (Thick)
        Concrete, Tilt-up (Thick)
        Stn. Ashlar Veneer, Block
        Stone, Rubble (Thick)
        Pilaster
        Bond Beams
        Insulation (Add)

b. <u>Curtain Walls</u>

Concrete, Precast
Concrete and Glass Panels
Metal and Glass Panels
Stainless Steel and Glass
Bronze and Glass
Stone Panels
Steel Studs and Stucco
Tile, Clay (Thick)
Facing Tile (Add)

c. <u>Wood or Steel Framed Walls</u>

Aluminum Siding
Asbestos Siding
Asbestos Shingles
Shingles
Shakes
Stucco on Wire and Paper on Sheathing
Wood Siding on Paper on Sheathing
Veneer, Common Brick
  Face Brick
  Stone
  Used Brick
Siding, Vinyl Surface
  Hardboard
  Textured Plywood
Board and Batten Box Frame
Log, Rustic
Insulation (Add)

d. <u>Wood or Steel Skeleton Frames</u>

Aluminum Cover
Sandwich Panels
Corrugated Steel on Steel Frame on Wood Frame
Transite
Siding, Post and Girder Frame
Sheathing (Add)

21. Heating, Cooling, and Ventilation: This particular data element is referring the system to a specific type of heating and/or cooling system. Types utilized by the system are:

Steam, with Boiler	Electric (Cable, Panel or Baseboard)
Steam, without Boiler	Electric Wall Heaters
Air Cond. Hot and Chilled Water	Forced Air
Air Cond. Warm and Cooled Air	Floor Furnace
Package Heating & Cooling	Gas Steam Radiator
Heat Pump	Gravity Furnace
Evaporative Cooling	Heaters, Vented
Regrigerated Cooling	Hot Water
Ventilation	Hot Water, Radiant
Wall Furnace	Space Heat, Gas
	Space Heat, Steam

These items are to be checked on the field data collection card for comparison with the appropriate table file for valuation purposes.

22. Elevators: This item indicates the existence of elevators (a yes/no response). A detailed summary of elevators by type is under Item No. 31.

23. Sprinklers: For the following cost headings: 1 = Low Cost; 2 = Average Cost; 3 = Above Average Cost; 4 = High Cost.

24. Residential Built-Ins: For valuation of apartments and condominiums, the following items will be noted on the commercial data collection card for valuation by the system.

Kitchen Appliances (Num. of Kitchens)

Bathroom Heater, Electric	Radio-intercom, Base System
Dishwasher	Add per Satellite
Exhaust Fan	Add per closed circuit TV Out
Exhaust Fan and Hood	Range and Oven Combination
Garbage Disposer	Range Top
Gas Incinerator	Refrigerator
Mixer-Blender (Food Center)	Trash Compactor (Single Unit)
Oven	Trash Compactor (Central Unit)
Oven, Microwave	Vacuum Cleaner System, 3 Outlets
	Add for Extra Outlets
	Window Air Conditioner
	Window Evaporative Cooler

25. Fireplaces: The number of stories and type of fireplace(s) are to be entered on the collection card for valuation.

26. Residential Garages: Garages are coded as to whether they are detached, attached, built-in or basement garage. Unless otherwise indicated, the same class and condition will be assumed for the garage as was input for the primary structure.

27. Porches: Porches are entered based on one of four categories:

    a. Slab (open)
    b. Slab (covered)
    c. Raised with steps (open)
    d. Raised with steps (covered)

28. Commercial & Institutional Built-Ins: The following items, when indicated, will be added into the cost as lump sum.

    a. Bank equipment (counters, vault dooes, etc.)
    b. Jail equipment (cell blocks, locking devices, etc.)
    c. Hospital equipment (Groups II and III)
    d. Hospital pneumatic conveyor system
    e. College commons kitchen equipment
    f. Science building laboratory equipment

29. Bank Vaults: The input for this lump sum addition will be the number of square feet of vault area in two categories: A) Money, and B) Record Storage. The system will contain appropriate costs for valuation of typical vault costs per classification of the improvement.

30. Stages & Permanent Fixtures: As with Bank Vaults, this item requires entry of the number of square feet of space occupied. Three use categories are provided with the number of square feet to be entered in the appropriate place:

    a. Live Performance
    b. Motion Picture only
    c. Speaker's Platform

31. Elevators: This data element requires the data collector to determine the number of shafts and the number of stops per shaft for the following types of elevators:

Multi-story Full Automatic
Multi-story Passenger Operated
Small Car 2 or 3 Stops
Frieght Elevator (Manual Doors)
Freight Elevator (Power Doors)
Sidewall Elevators
Escalator (Enter Number of Stairways)

32. Mezzanines: A mezzanine is an intermediary floor having less area than the regular floors. The system will require the data collector to determine the amount of square feet which fall within the appropriate type of space as follows:

a. Display
b. Office
c. Storage
d. Open

33. Balconies: Balconies are defined as, "A balustrade or railed platform projecting from the face of a building above the ground level with an entrance from the building interior, usually cantilevered or supported by columns. In a theater or auditorium, a partial upper floor with seats".

a. Apartment
b. Auditorium
c. Church
d. Theater

34. Docks: Loading docks are entered into the valuation system by the number of square feet of area for "loading docks" either with or without refrigeration requirements. Additional input by the data collector is required if there are shipping docks. Entry should be made in terms of square feet of area and the height of the shipping dock from ground level.

35. Additions: This item within the system allows the appraiser the flexibility of having other cost items not included above. These are to be entered as lump sum costs.

C. Income Property Data Elements

The data elements utilized by the system for valuation of commercial properties using the Income Approach to value are:

Gross Income
Vacancy and Credit Loss
Expense Items

While these data elements will be re-enumerated in the Income Approach section of this manual, they are defined here in order to fully describe the entirety of the real estate data base.

36. Gross Income: Gross Income is the scheduled income from the operation of the business or management of the property, usually stated on an annual basis.

In the appraisal of real estate, "scheduled income" is referring to rental income and miscellaneous income generated by the property, not by the business occupying the property.

This is often referred to as "potential" gross income, referring to the income which would be produced under typical management with a 100% occupancy rate. Gross Income will be located within the data system in table files stored by property type or occupancy code.

The table files will store data per unit of economic (market) rent, such as office space per square foot (Net Leasable Area); retail space per square foot (Gross Leasable Area); apartment space per unit or square foot; motel space per average daily rental. Table files will also store "miscellaneous income" such as income derived from parking, vending machines, etc. This miscellaneous income will be filed as a percentage of gross income for each respective occupancy code.

When possible, the table files will be checked and updated using published income and expense data such as BOMA, The Dollars and Cents of Shopping Centers (Urban Land Institute) and Income and Expense Analysis for Apartments, Condominiums and Cooperatives (Institute of Real Estate Management). The validity of these sources may be checked periodically by utilizing income and expense questionnaires sent to all owners of commercial properties. The combined result of all of this input data will be accurate table file for gorss income. An override feature will be available for the appraisers if there are instances when the table file does not seem to be accurate. All overrides should be approved by the supervisor before valuations are considered final.

37. Vacancy and Credit Loss: Vacancy and credit loss provides the opportunity to make an allowance for whatever typical vacancies are for particular property types and also to allow for some losses due to credit risks or non-payment of rentals. The system will store typical percentages for various occupancy types. There will be as a percentage of gross income. Override capabilities will be available for the individual appraiser in the instance a property does not, for some reason, conform to the typical situation.

The allowances for vacancy and income loss has been defined as, "that amount deducted from potential annual gross income to reflect the effect of probable vacancy and turnover, or non-payment of rents by tenants; commonly expressed as a percentage of potential annual gross income and then converted to a dollar figure; the percentage of vacancy and income loss is the complement of the occupancy ratio".

38. Expenses Operating expenses are defined as, "...all expenses necessary to maintain the production of income from operation of a property; the difference between effective gross income and net operating income. Also used to denote a category of expense exclusive of fixed expense, debt service, depreciation, and reserves for replacements".

Expense items are stored in the system by expense type and property type. There are fourteen expense items within four general topic areas. These are as follows:

A. Maintenance and Operating Expense

    Total Payroll Expense

    Supplies

    Painting/Decorating

    Maintenance/Repair

    Service

    Miscellaneous Operating Expenses

B. Utility Expenses

    Electricity

    Water

    Gas

    Heating Fuel

C. Administrative Expenses

    Management Fees

    Other Administrative Costs

D. Taxes and Insurance

Insurance

Non-Real Estate Taxes

These expenses will be stored as a percentage of gross income. The percentage will be for each expense item and also for the total of each of the four groups of expenses listed above. The system will have the capability of calculating expenses on any generated gross income with or without an owner's operating statement.

The system will automatically calculate the expenses alloted for that occupancy code from the stored expense items percentages. If there is an owner's operating statement, the system will also display the actual input expenses (as they fit into the expense categories above) for comparisons. In addition, the system will allow for the appraiser to manually override the total expenses or four subtotal areas as a percentage of gross income. Override capabilities should only be utilized in those cases where unusual circumstances dictate that the allowances stored in the table file are unacceptable. All overrides should be documented and approved by the appropriate appraisal supervisor.

A brief description of each of the expenses is provided below:

39. Total Payroll Expense: Payroll expense refers to the salaries of those persons working in the management or maintenance of the property involved. These salaries are "property related", not "business related". The salary of a clerk in a pharmacy store would not be a payroll expense as it is business related. The salaries of the cleaning and maintenance crews which clean the shopping center which contains the pharmacy are legitimate "payroll expenses".

40. Supplies: Supplies refer to any material which is used in the continued operation of the building. Most common items will be material supplies for purposes of maintenance. Office supplies would only be allowable to the extent that they represent those used in maintenance of the physical structure.

41. Painting and Decorating Expense: Painting expense refers to the cost involved in painting unoccupied apartment units. Periodic exterior painting should be "pro-rated" so that only the portion prorated for one year would be reflected in any given year. Decorating only refers to that amount of decorating which is done each year and which is directly related towards maintaining the rental income to the property.

42. Maintenance and Repair: These items should reflect only those costs related to the maintenance of the "property". They might include repairs to the roof (not re-roofing) and all other maintenance oriented expenses incurred on an annual basis.

43. Service Expenses: Service expenses include those costs from pest control services, garbage disposal, lawn care, etc., which are anticipated to occur on an annual basis. Any expense item should be directly related to the continued flow of income to the property.

44. Miscellaneous Operating Expense: This allows for any unusual operating expenses which may not fit into one of the five categories above but is necessary for continual operation of a particular property. This should reflect only anticipated annual expenses, not any "one-time" or periodic costs.

45. Electricity: This represents the anticipated annual cost of electricity to the property for a twelve month period. Costs will be built into the table file and may be updated with owner verification.

46. Water: This item represents all annual charges for water usage to the property. As with all expense items, the typical usage for each occupancy code will be used with availability for override with proper documentation.

47. Gas: The annual typical dollar allowance for gas (if applicable) to the individual occupancy code will be computed by the system.

48. Heating Fuel: Represents the typical annual fuel cost for the various occupancy codes.

49. Management Fees: Management fees usually range from 6-9 percent of effective gross income. The typical percentage utilized by property managers in the Boston area will be applied automatically by the system. There should be a notation to indicate if a property does not have a "property manager" to see that the system will not allow double accounting under payroll and under this item. Management fees are to be stated as annual expenses to the property.

50. Other Administrative Costs: These include any annual administration costs which might not come under the heading or management fees.

51. Insurance: This item covers only those annual expenses incurred in insuring the "property" against fire, theft and actions of the elements. Personal life insurance would not be permissable as this is a business expense, not a property expense. Care should be taken to determine that costs provided represent only annual charges since many commercial policies are for three to five years.

52. Other Non-Real Estate and Income Tax Expenses: This excludes all personal and corporate real estate and income tax expenses. Allowances for real estate taxes will be built-into the capitalization rate. Income taxes are tailored to the individual's income and may vary between two individual owners.

d. Commercial Land Characteristics

The commercial data base consists of the following elements.

Physical Land Characteristics

Locational Characteristics

Physical Land Characteristics

53. Area: This data item is calculated by the data collected and checked by the data verifiers. It basically, refers to the width times the depth of a rectangular lot. Irregular lots may be measured from the mapping departments records with a planimeter.

54. Width: The number of feet across a lot. When the shape of the lot is irregular, the width may actually be an average of the sides.

55. Depth: The number of feet from the front of the lot to the rear of the lot. When a lot is irregular in shape, the depth may actually be an average of the sides.

56. Topography: The slope of the land and soil "perk" are important determinents for commercial development. Options for "yes/no" checks will be low/wet, low/fast, level and high.

57. Lot Shape: Shapes will be indicated as square, rectangular, or irregular.

58. Excess Land: All land will be valued based on a standard lot size. This data element will allow for input of an excess over the specified standard size for that area.

59. Street Type: This item refers to the type of street pattern surrounding a property. Options provided will be residential, arterial, state or U.S. Highway or Interstate.

60. Street Exposure: This data item will indicate whether a commercial lot is an inside or a corner lot.

61. Street Access: This data element will indicate whether or not the property may be accessed from one street, or two streets, three or more streets, or if it has limited access.

62. Utilities: Available utilities to the property will include water, sewer, eletric, and gas.

63. Transportation: Transportation refers to the available types of public transportation such as none, bus, rapid transit, train and air freight (within a reasonable distance to Logan Airport).

64. Rail: This data element refers to whether or not there is an available easement connecting with a rail for purposes of a rail-spur on the property.

65. Water: This item refers to the nearness of a property to a navigable river, bay or ocean.

4. Data Base Requirements, Sales Analysis File:

The Sale Transaction File will serve as a storage area for data which will be utilized in the Market Analysis Module, as described in that portion of this report. Data elements required for this file are of three types:

A) Property Identification Characteristics

1. Name, Address, and Legal Information
2. Occupancy Code and Construction Classification

B) Sales Transaction Data

C) Specific Data for Market Analysis (to be retrieved from existing files)

These items are individually listed below. The items which have been previously listed are so referenced. Items which will be used but not stored (because they are already stored elsewhere in the system) will be listed so as to present a complete view of this file.

A) Property Identification Characteristics

1. Name, address, and legal information. These data items will be the same listed under paragraph A(a) of the previous section. These items, as defined earlier, are:

1. Unique Parcel Identification Number
2. Map, Block, and Lot Number
3. Property Address
4. Coordinate Locator Number
5. Data Processing Number
6. Ward Number
7. Neighborhood Code
8. Zoning Data

2. Occupancy Codes. The occupancy code will be one of those listed above in paragraph B(a) (2) of this section of the manual.

B) Sales Transaction Data

The Sales Transaction Data elements are obtained from the Deed Abstract Form from the Registry of Deeds. The specific items utilized are:

1. Sales Price: The amount of total consideration paid in a sales transaction. If necessary, verification of the sales price may be obtained by contacting the principals to the sale.

2. Date of Sale: The day, month, and year of the sales transaction comprise this data element.

3. Deed Reference: a) The deed book and page number where the Warranty Deed is located. b) The deed book and page number where the security deed (if applicable) is located. c) The envelope book and page number where the plans of the property may be found.

C) Specific Data for Market Analysis

Land Value: The land value will be automatically extracted from the master real estate file.

Replacement Cost New Less Depreciation: The RCNLD will be automatically extracted from the master real estate file.

The products of the data contained in this file will be seven statistical indicators. These are listed below. A detailed explanation of each indicator may be found in the Market Approach an Performance Analysis section of this report. The indicators are:

1. Sales Assessment Ratio
2. Aggregate Ratio Report for the City of Boston
3. Ratio Analysis by Location (Neighborhood)
4. Ratio Analysis by Property Type
5. Ratio Analysis by Grade (Class) for Residential and Commercial
6. Calculation of Land Value by Abstraction
7. Calculation of Market Adjustment Factor

CHAPTER THREE - AUTOMATED SYSTEM DESIGN

*The assistance of Mr. Joseph T. Kowalik, Systems Analyst, Office of Property Equalization, in the preparation of this Chapter is gratefully acknowledged.

AUTOMATED SYSTEM DESIGN

INTRODUCTION

In this chapter the technical considerations in the development of an Equalization System for the City of Boston will be addressed. In particular, the roles that computerized procedures and equipment will play are identified. It has been recognized that the City of Boston will rely significantly upon computerized systems in support of achieving its equalization objectives. This chapter has three sections:

1. Automated System Development Phases:

   This section describes the framework which will be utilized in developing automated support for the Equalization System. This description includes the logic behind the particular framework chosen and briefly identifies the distinct components in the system development process.

2. System Requirements:

   This section, which constitutes the main body of this chapter, describes in functional, non-technical terms, exactly what the anticipated automated support should contain. The functions are explained in the hierarchical terms of the system: system, subsystem, module, task. The programs and files defined in the system are identified, and flow charts are presented for the three subsytems and three valuation modules.

3. Additional System Design Considerations:

   In this section a number of considerations are identified which affect the final automated support. When possible, alternative courses of action are given and parameters for making a decision are listed. However the considerations identified in this section requires further analysis by the Equalization technical staff.

I. AUTOMATED SYSTEM DEVELOPMENT PHASES

In order to provide accurate assessments that are derived efficiently, equitably and which are updated regularly, the City of Boston Equalization System will require substantial automated support. Given the scope, complexity and importance of this system in Boston, a System Development Approach developed by IBM has been adopted. Their system development process consists of three phases:

A. Phase 0: Requirements

The operating environment of the automated system development is identified and analyzed in this phase. It involves identification of statutory, administrative, organizational, time and cost requirements. It identifies all the information flows which should take place into, out of and within the Equalization System. The flows are analyzed with regard to volume, frequency and importance, and described in non-technical, orgaizationally functional terms.

B. Phase 1: Design

This phase draws heavily on the Requirements Phase to establish logical relationships among the identified information flows. Decisions are made as to how the information flows should be organized and indexed (system concepts) and whether the information storage and processing should be manual or computerized. For each information flow the information inputs, processing and outputs are described in both general and detailed terms. Technical decisions such as hardware and software configuration and processing mode (e.g. interactive versus batch) are made for the computerized components of the system.

C. Phase 2: Development

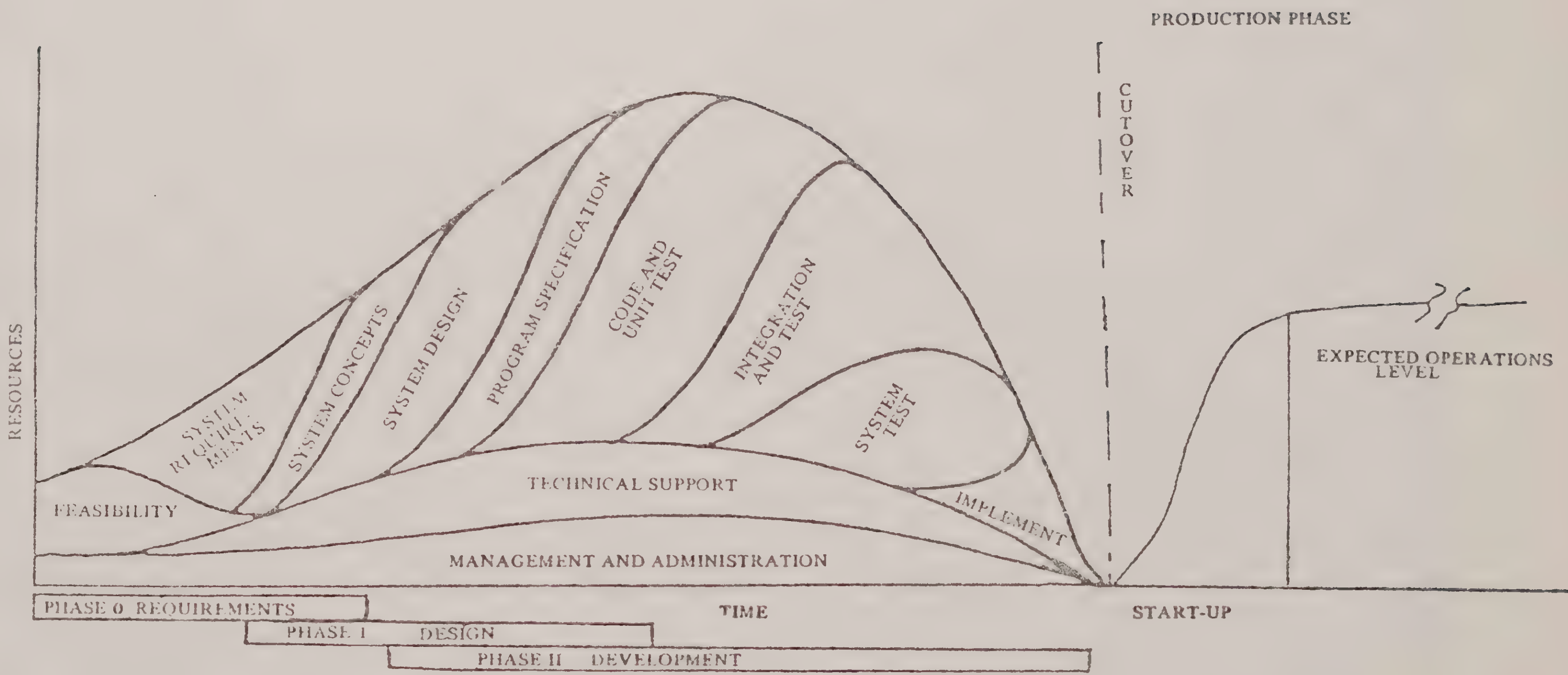
This phase draws on the Design Phase to actually develop components of the system. The activities undertaken here are largely technical, and involve the coding of programs, allocation of space within the computer for data files, and coding of processing procedures. As the components are developed they are tested and evaluated with regard to stated design specifications (phase 1) and general system requirements (phase 0). Design modifications should realistically be expected, and are made at this point. Components are successively tested, modified, tested again, approved and integrated with other components. After all components are developed, tested and integrated, system-wide testing occurs. The final step in Development Phase is to load the automated system on the City computer for actual use (implementation).

An important point to note is that the system is not fully operational upon implementation. Personnel within user departments must be trained as to proper use of the system. Operational irregularities ("bugs") are to be expected and will require resolution. Also, certain types of data may be loaded into the system on a day forward basis so that production processing connot occur until months after the system implementation.

The relationships between phases and the distinct components within each phase are graphically illustrated on the next page.

CITY OF BOSTON PROPERTY EQUALIZATION

AUTOMATED SYSTEM DEVELOPMENT PHASES



SOURCE: "Recommended Activities For Project Development", Technical Bulletin. D.I. Rumney, IBM Corporation, Palo Alto Systems Center, February, 1978

II. SYSTEM REQUIREMENTS

Drawing upon the approach outlined in Section I of this chapter a statement of the Automated System Requirements is presented here. It is presented in three subsections:

A. System Functions Narrative

B. System Component Inventory

C. Flow Charts

A. System Functions Narrative:

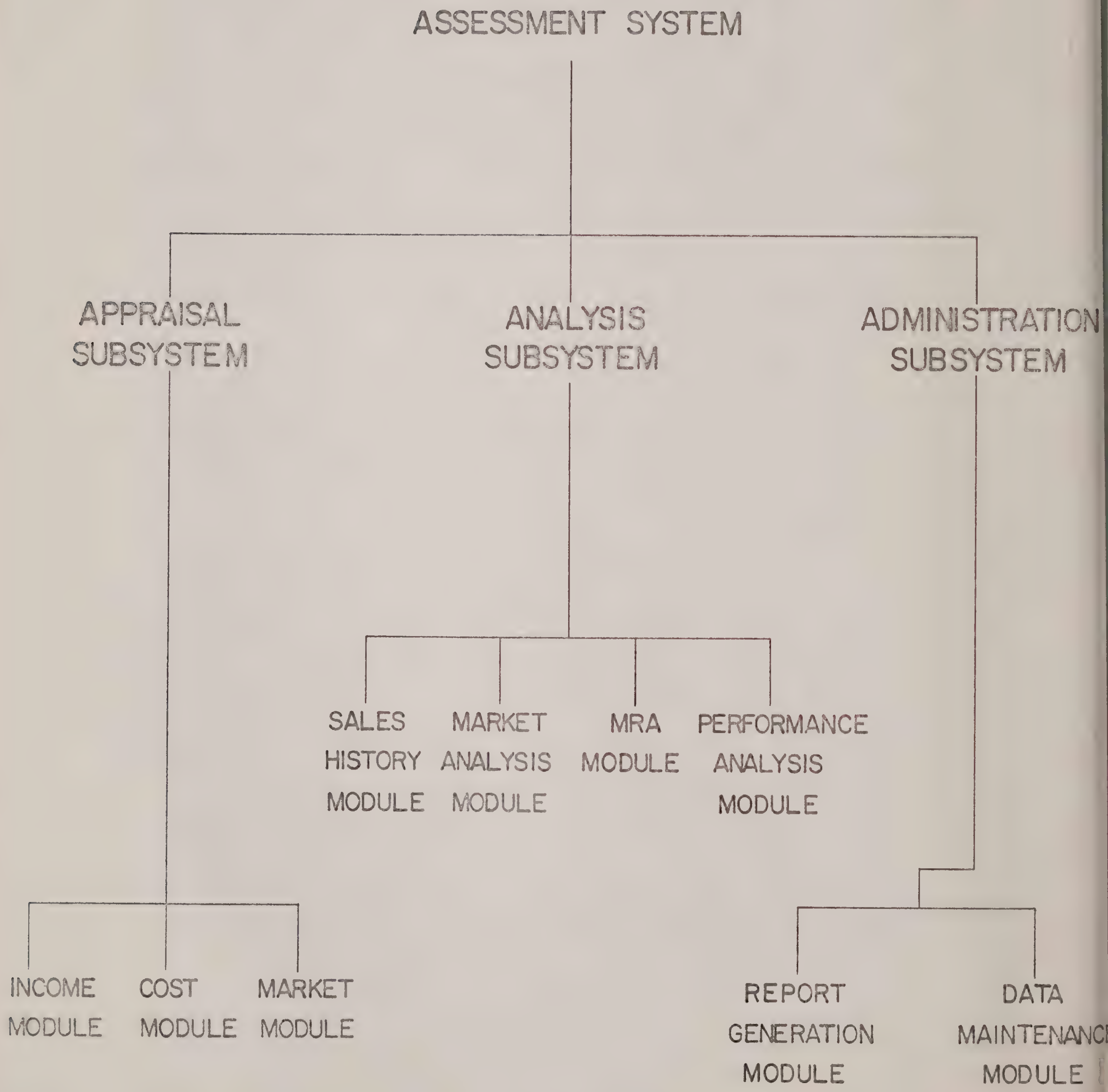
There exist two approaches to developing a System Functions Narrative. For lack of better terms the two approaches are described as "Top Down" versus "Bottom Up". Each approach has its relative strengths and weaknesses. Based on an evaluation of circumstances regarding the City of Boston assessing function, it was determined that the Bottom Up Approach was more appropriate.

The distinctions between the two approaches is succinctly reduced to the following: The Top Down Approach as applied here would require the initial analysis to occur at the interdepartmental, intergovernmental levels.

In constrast, the Bottom Up Approach requires the definition of functions within the Equalization System itself, in order of their importance. The single most important function within the Equalization System is deriving fair market values for all taxable parcels. Given that evaluating valuation methodologies was also the most important immediate Equalization task the Bottom Up Approach was chosen.

To aid in conceptually understanding the System Functions Narrative an illustrative delineation of system functions is presented below. The System Functions Narrative which follows is limited to the three subsystems of the Equalization System.

AUTOMATED EQUALIZATION SYSTEM ORGANIZATION



1. Valuation Subsystem or Appraisal Subsystem

The Valuation Subsystem consists of the Cost, Income and Market Approaches to value. These modules all require the Parcel Master File and/or Sales History File. The final value determination made by the system is a function of the cost, market and income appraisal estimates. This final value is called the correlated value estimate. The final combination of values may be made by averaging or by weighted averaging. The appraiser, after careful examination and documentation may override or adjust this system value estimate. The three approaches to value need not be applied to every property. For example, only Market and Cost Approaches may be used for certain residential property valuations whereas Cost and Income Approaches may be used for commercial property valuations.

The three approaches to value are not independent of one another. Cost data is often a useful variable in market valuation, therefore cost valuation should occur before market valuation. Income valuation is typically independently derived. Therefore, the Equalization System is designed to perform the Income Module first, Cost Module second, and Market Module last.

Each valuation module requires special table files. The contents of these files will be discussed below. These table files are dynamic and must be kept current by continuous monitoring of the real estate market. The Cost Module for example, utilizes depreciation tables. These tables will change according to market sales analysis. Similarly, the Income Module contains expense percentages by occupancy, grade and neighborhood. These neighborhood equations must be adjusted as the sales analysis indicates changing market trends.

An overview of the functional flow includes the following steps for each parcel valuation:

(1) Determine valuation modules to be used.

(2) Execute Income Module to derive income value estimate.

(3) Execute Cost Module to derive cost value estimate.

(4) Execute Market Module to derive market value estimate.

(5) Correlate the values produced in Steps Two and Four

(6) Print the Appraiser's Work Sheet of system generated value estimates.

(7) Review system valuation estimates.

(8) Submit all value and property characteristic adjustments or overrides to the Equalization System.

(9) Update Parcel Master File with new values and/or property characteristics.

(10) Repeat Steps One to Nine for each property until a satisfactory value is derived for each parcel.

The system can be run separately for each neighborhood, or run City-wide.

a. Income Valuation Module or Income Module

The Income valuation procedure is based upon the capitalization of net income. Net income is obtained by subtracting expenses from gross income. In the Equalization System, gross income is based on a unit rate assigned to each parcel. The unit rate, expense percentages of gross income, and capitalization rates are stored in income table files. More detailed information on the income approach is found in Chapter One, Section 3 of this report. Functional features of the Income Valuation Module are now given:

Income Module Table Files:

The Income Table Files are organized and indexed by neighborhood, occupancy and construction quality grade. For each combination of neighborhood, occupancy and grade, the respective table file contains (1) a unit economic rent factor, and vacancy and credit percentage, (2) fourteen expense percentages (3) a capitalization rate. All percentages are based upon gross income.

Income Calculations:

Property records are accessed from the Parcel Master File. If the Income Approach is to be applied, the record is processed. If the Income Approach does not apply to this parcel, then the income value estimate can be set at zero. If the Income Valuation Module is to be utilized the neighborhood code, occupancy code and grade are read from the parcel record. These parameters access the table files for the unit economic rent factor, expense percentages, vacancy and credit percentages and capitalization rate. (The parcel record may contain multiple occupancy codes.

or grades). The table file percentages are used by the program unless the parcel record contains an override value as supplied by the appraiser.

The Income Valuation Module then proceeds as follows:

(1) Calculate gross income for each occupancy code and grade. This calculation is made by multiplying the rate in the Income Table File by the total square ft. value found in the parcel record. These income amounts and any miscellaneous income stated in the parcel record are summed. (The miscellaneous income is supplied by the appraiser to the parcel record).

(2) Calculate the vacancy and credit loss by multiplying the percentage found in the table file times the gross income total in Step One. Subtract this value from the value in Step One.

(3) Calculate expense estimates by multiplying expense percentages by gross income. Expenses will be subtotaled into four catagories: Maintenance and Operating, Utilities, Administrative, and Taxes and Insurance. Subtracting this value from the value in Step Two will give the net operating income.

(4) Calculate the income value estimate by dividing the net operating income derived in Step Three by the appropriate capitalization rate. The capitalization rates are indexed by neighborhood, occupancy and grade.

(5) Store the income valuation from Step Four in the appropriate parcel record in the Parcel Master File.

b. Cost Valuation Module or Cost Module

The Cost Valuation Module as presented can accomodate a commercially available cost manual or an in-house cost manual. Details of the costing procedure are found in Chapter One Section 2.

The derivation of the estimated cost value follows accepted appraisal standards. A base value is determined as a function of the building construction type, quality class, design type, story height and exterior wall type. This base value is adjusted for such items as garages, porches and fireplaces. The adjusted value is the replacement cost new (RCN). The RCN is then depreciated by a depreciation percentage found in a table file. The depreciation cost is called the Replacement Cost New Less Depreciation (RCNLD). To arrive at the cost value estimate, the value of yard improvements and land value are added to the RCNLD. The components of the Cost Valuation Module are now defined:

Base Rate Table File

This file contains a rate, expressed as dollars per square foot, organized by construction type, quality grade, design type, story height, and exterior wall type. These five property characteristics are referred to as the Cost Table File Index or Cost Table File Key. The rate usually is defined for square footage of living area.

Adjustments Table File

This file contains adjustments as a percentage of base value or actual adjustment values. This file may be organized into subfiles for each adjustment item, such as porches and garages.

Depreciation Table File

This file contains depreciation percentages organized by effective age and construction grade. A separate depreciation schedule exists for each Cost Table File Key combination (construction type, quality grade, design type, story height and exterior wall type).

Land Value Table File:

This file contains the land values. These table values may be defined as a rate (expressed as dollars per square foot or per front foot) or lump sums.

Cost Calculations:

Property records are accessed from the Parcel Master File for those parcels which are to be costed. The Table File Key and other property characteristics (such as effective age) used in costing the parcel are extracted from the record. The following steps are involved:

(1)Access Appropriate Base Value Table indexed by Table File Key.

(2)Determine Base Value from Base Value Table File and record information.

(3)Calculate all add on adjustments.

(4)Sum the values in Step Two and Three.

(5)Access the appropriate Depreciation Table, indexed by Table File Key. Find the depreciation percentage as a function of the effective age and construction grade. Multiply this percentage by the RCN as derived in Step Four.

(6) Calculate the RCNLD by subtracting the accumulated depreciation in Step Five, from the RCN in Step Four.

(7) Access the appropriate Market Adjustment Factor, indexed by market adjustment area. Multiply this number times RCNLD, as derived in Step Six.

(8) Add to the value in Step Seven any land improvements and land value. The value may be derived as a value in the parcel record or as a unit (square foot) value in a table file which would by multiplied by a parcel's total square feet, as listed in the parcel record.

(9) Store the cost value estimate in the appropriate record in the Parcel Master File.

c. Market Valuation Module or Market Module

The Market Valuation Module begins by extracting the MRA Equation Table File Key from the record parcel. The MRA Equation Table File Key accesses the appropriate record within the MRA Equation Table File. Each record contains an MRA-derived equation which predicts value as a function of specified property characteristics. The appropriate property characteristics are extracted from the parcel record and used in the equation to estimate market value of the subject property. Details concerning the functions for the Market Module are found below and in Chapter One, Section 4.

MRA Equation Table File:

This file, organized by neighborhood, contains equations used to estimate market value based upon property characteristics. It is assumed that neighborhoods have been defined with as few properties as possible.

The equations stored in the Table File are developed through independent sales analysis utilizing multiple regression techniques. Since cost parameters such as RCN or RCNLD may be variables in an MRA equation, the Market Valuation Module should be executed after the Cost Valuation Module.

The number of variables in each equation is determined by the sales analysis within each neighborhood. A simple example of an MRA equation is:

Value=10 (sq. ft.) + 3,000

Here, value is obtained by multiplying 10 by the number of living area square feet and adding 3,000. Square footage is the single independent variable. Of course the actual equations will contain multiple independent variables.

MRA Calculations:

The MRA Equation Table File Key is extracted from the Parcel Master File for each parcel being valued. Then the MRA equation associated with that key is taken from the Table File. Each property characteristic required in the equation is located in the parcel record. The independent variables may use parcel characteristics exactly as they are stored in the Master File, or edit routines may be utilized to reformat data before it is fed to the equation.

The following steps are performed in this module:

(1) Locate the neighborhood identifier in the Parcel Master File.

(2) Locate the associated MRA equation in the MRA Equation Table File.

(3) Locate the property characteristics used in the equation from the Parcel Master File record.

(4) Multiply the property characteristics values by the associated equation coefficients.

(5) Sum all the terms in the equation.

(6) Add the equation constant to the sum of products obtained at Step Five.

(7) Store the market value estimate obtained in Step Six in the appropriate parcel record in the Parcel Master File.

2. Analysis Subsystem

In this section, the analytical capabilities of the Equalization System are identified. These capabilities are organized in four modules:

a. Sales History Module

b. Market Analysis Module

c. Multiple Regression Analysis (MRA)Module

d. Performance Analysis Module

Analytic activities are an integral part of the system design. The information produced is used to upgrade and maintain the table file data necessary to produce valuations. The analysis also provides support and documentation for the valuation procedures.

a. Sales History Module:

The Sales History File is a primary source of data for analysis. This file contains data for each sale or conveyance including the sales price, sales date, ownership data and the physical characteristics of the property at the time of the sale. It may also contain other sales related data if future analysis indicates such a need.

The parcel number is not a unique file key for the Sales History File, since the same property can be sold several times. Thus, it is recommended that a concatenated key, consisting of the parcel number and a sales sequence number, be used. The sales sequence number should be large enough to allow for multiple sales over many years. The number increments by one with each sale of the same property.

The following procedure outlines the creation and maintenance of the Sales History File:

(1) Enter sales parcel number and date into Sales Transaction File.

(2) Process each record on the Sales Transaction File. Read the parcel number and locate this number on the Parcel Master File.

(3) Copy the entire parcel record into the Sales Transaction File.

(4) Add the appropriate sales sequence suffix to the parcel number and edit the sales data. Store the record in the Sales History File.

b. Market Analysis Module

The following market analysis reports will be generated in this module:

Market Depreciation:

This report is based upon development of depreciation curves from market information such as effective age and construction grade.

Land Value Abstraction:

Estimates of land value can be obtained by subtracting market adjusted RCNLD from sales amounts and curve fit against units such as square footage or front footage.

Market Adjustment Factor:

The adjustment of cost value estimates to the market place is developed by analyzing sales less land against RCNLD. This factor is called the Market Adjustment Factor.

c. MRA Module

The MRA Module consists of the necessary analytic capabilities for developing regression equations by neighborhood. Developing the updating equations is necessarily a reiterative process. This Module is comprised of the following components:

Sales Extraction:

Sales information is extracted from the Sales History File to create an MRA Data File. The extraction process selects sales information based on predefined date and property characteristic criteria. For example, only sales which occurred in the last 6 months, are located in neighborhood 3, and contain at most 2,000 square feet might be selected.

The selection algorithms must be general enough to give the analyst a reasonable number of sales, yet specific enough to select comparable properties.

MRA Data File:

The sales selected above must be stored for analysis. The program that stores the sales data must also allow for reformatting of the property characteristics. For example, the number of baths can be used as a regression variable. However, it may be preferable to store this data in a dummy variable format: namely, does the property have 1 bath, 2 baths, or 3 baths. This file of selected, reformatted sales is the MRA Data File. A file is created in this manner for each neighborhood being modeled.

Histogram and Statistical Profile Study:

The sales sample in the MRA Data File must be statistically significant and representative of the parcel population. Such verification can be made by producing histograms of different variables and comparing them to histograms of the entire neighborhood. For example, if histograms of square footage for a given neighborhood show that the neighborhood population mean is 2,000 square feet and the sales sample mean is 1,000 square feet, the sample may be rejected as not being statistically comparable. Note that when processing histograms for an entire neighborhood, the program acesses the Parcel Master File and not the MRA Data File.

Stepwise Mutliple Regression Analysis:

Given an acceptable sample of sales, the formal process of developing an equation (or model) utilizes a stepwise multiple regression analysis technique. This particular technique is chosen for its implementation each and capacity for addressing multicollinearity. The technique should generate evaluation statistics based on the independent variables used in the equation. These statistics include the residuals, standard errors, coefficients of dispersion, and coefficents of determination. This same stepwise algorithm can also be used to find functional relationships in other appraisal application areas.

Store in MRA Equation Table File:

Once an equation has been refined and determined acceptable, it is stored in the MRA Equation Table File. This Table File is described above in the Market Valuation Module.

d. Performance Analysis Module

The analytical capabilities described in the modules above are essential in maintaining Equalization System table files. Additional analytical capability is needed to support appraisal management decisions. Two of the sales analysis reports required for this purpose are listed below:

Sales Ratio Listing:

This analysis provides a statistical view of the sales to assessed value ratios for each parcel sold.

Sales Ratio Summary Report:

This report contains ratio analysis stratified by

Property type and grade.

3. Administration Subsystem

System functions which do not compute values or provide analysis are contained in the Administrative Subsystem. Specifically this Subsystem includes a Production and Analysis Report generation capability and data maintenance routines. The Administration Subsystem is outlined below:

a. Report Module:

(1) Production Reports:

The principle Production Reports include Tax Rolls, Property Record Cards, and Appraisal Worksheets. The generation of tax rolls is a long established computerized report requirement in the City of Boston. The new automated capabilities include the generation of Property Record Cards and Appraisal Work Sheets. The computer generated Appraisal Work Sheet serves as both an input and output document. All appraisal related changes in the Parcel Master File are entered on these sheets. The Work Sheets also serve as a hard copy record of the parcel to the field appraiser. In addition, the Work Sheets may contain building sketches. If sketches are to be generated. sketch table and data files are required.

(2) Analysis Reports:

The appraiser requires information in addition to the reports identified in the Analysis Subsystem. A partial list of these reports is given:

Comparable Sales Search:

Given a subject property, this report searches the Sales History File to list the set of comparable sales. The test for comparability is based upon a direct comparison of selected property characteristics within some pre-defined range.

Sales Listing by Neighborhood and Property Type:

This listing of sales, defined by neighborhood and property type, is used by field appraisers to perform manual sales ratios and other field analyses.

Income/Expense Data Reports:

These reports generate income and expense information required by the Income Valuation Module.

b. Data Maintenance Module:

This module functions as the central processer of all the data editing, updating and maintenance required by the Equalization System. It also provides an Edit Log File for specified types of file updating. This Edit Log File serves as an audit trail for Equalization System management. The success of a properly maintained automated Equalization System will depend on the functions contained within this module. Given that vast amounts of continuous updating will occur, the need for capabilities which prevent inaccurate or illogical data entry is great. Edit routines will check for validity of codes, code types and reasonableness, (e.g. a date cannot have a month code other than 1 to 12, no single family residential property will have 30 baths, etc.). Edit routines are also required to prevent entry of updated but incomplete information. Also, given the sensitivity of certain data elements, the Data Maintenance Module must control access to computerized files by requiring password access from properly identified terminals. The Data Maintenance Module software will consist of a series of edit print procedures. Therefore, for each edit or update, a listing of unsuccessful attempts at the system can be listed. Successful operations can also be listed when such information is desired.

B. System Component Inventory

Explicit file and program requirements are delineated within the System Functions Narrative. However, the same programs and files are used not only in multiple modules but in multiple subsystems. Therefore a succinct listing of all stated programs and files is nedded. The following summaries uniquely list the required programs and files identified to date.

1. Program Summary

The tasks requiring computer programs are summarized here. The actual number of computer programs eventually developed may not be in one-to-one correspondence with the number of detailed tasks. However, a one-to-one correspondence is a reasonable assumption and serves as the basis for estimating the magnitude of required programming resources. The estimated number of man-weeks are based upon several assumptions: All programs are to be newly written in a higher level computer language such as COBOL; all system analysis, programming, testing, and debugging is included; documentation is not included; data capture and entry is not included. The major tasks are coded A=Collection/Conversion, B=Valuation, C=Analysis, D=Administration.

PROGRAM DEFINITION	TASK CODE	ESTIMATE-MAN WEEKS
1. Create/Edit Cross Reference Trans. File	A	4
2. Create Cross Reference Master File	A	4
3. Edit/Reformat Existing Real Estate Master File	A	3
4. List Reformatted Parcel Master File	A	2
5. Edit Parcel Master File	A	3
6. Create/Edit Appraisal Data Trans. File	A	4
7. Update Appraisal Data Trans. File	A	4
8. Parcel Master File Maintenance (appraisal data)	A	8
9. Create Appraisal Data Master File	A	4
10. List Appraisal Master File	A	2
11. Print Appraisal Work Sheets	A	12
12. Create/Edit Sketch Trans. File	A	6
13. Create Sketch Table File	A	6
14. Sketch Table File Maintenance	A	8
15. List Sketch Table File	A	2
16. Modify Existing Real Estate Program	A	24
17. Create/Edit Income Valuation Module Table Files	B	6
18. Edit/Update Income Valuation Module Table Files	B	6
19. List Income Valuation Module Table Files	B	2
20. Income Valuation Calculation	B	4
21. Create/Edit Cost Table Files	B	40
22. Edit/Update Cost Table Files	B	30
23. List Cost Table Files	B	15
24. Cost Valuation Calculation	B	8
25. Create/Edit Sales History File	B	6
26. Edit/Update Sales History File	B	6
27. List Sales History File	B	2

PROGRAM DEFINITION (cont'd)	TASK CODE	ESTIMATE MAN-WEEKS
28. Sales Data Extraction From Parcel Master	B	2
29. Sales Extraction From Sales History File	B,C	12
30. Create MRA Data File	C	16
31. Statistical Profile Analysis	C	24
32. Stepwise Regression Analysis	C	24
33. Create MRA Data File	C	16
34. MRA Valuation Calculation	B,C	6
35. Sales Ratio Analysis	C,D	16
36. Comparable Sales Search Analysis	C,D	12
37. Depreciation Analysis	C,D	8
38. Land Value Analysis	C,D	10
39. Create/Edit Income/Expense Trans. File	C,D	6
40. Edit, Update Income/Expense Trans. File	C,D	8
41. Create Income/Expense History File	C,D	6
42. List Income/Expense History File	C,D	2
43. List Appraisers Maintenance Log	D	2
44. (10) Regular Management Reports From Parcel Master File	D	20
45. Data Edit Routines	D	20
46. Data Update Routines	D	20
47. Data Audit Routines	D	45

TASK- PROGRAM SUMMARY	MAN WEEKS	
1. Conversion		
a. Existing System	13	
b. Appraisal System	34	
c. Sketch System	22	
Conversion Total		69
2. Existing System Program Modification	27	27
3. Valuation Subsystem		
a. Income Module	18	
b. Cost Module	93	
c. Market Module	76	
Valuation Total		187
4. Analysis Subsystem		
a. Sales History File	28	
b. Sales Ratio Study	16	
c. Comparable Sales	12	
d. Depreciation Curves	8	
e. Land Valuation	10	
f. Income/ Expense Study	22	
Analysis Total		96
5. Administration Subsystem		
a. Reports	20	
b. Data Maintenance	85	
Administration Total		105
Grand Total		484

2. File Summary

In this section, a summary of the main files which exist in the system is presented. The summary provides estimated record counts, number of bytes per record and total bytes per file.

File Summary

	File Name	Est. No. Records	Bytes/ Record	Total Bytes
1.	Parcel Master File	150,000	1,500	225,000,000
2.	Sales History File	40,000	1,500	60,000,000
3.	Income Table Files	12,000	120	1,440,000
4.	Cost Base Rate File	2,500	400	1,000,000
5.	Cost Base Adjustments File	10,000	80	800,000
6.	Cost Depreciation File	1,000	80	80,000
7.	Cost Land Improvements File	1,000	80	80,000
8.	Cost Land Table File	1,000	80	80,000
9.	MRA Equation Table File	100	300	30,000
10.	Sketch Table File	100,000	200	20,000,000
11.	MRA Data File	200	200	40,000
12.	Cross Reference Index File	100,000	40	4,000,000
13.	Income/Expense Data Files	52,800	300	15,840,000
				328,390,000

SYSTEM REQUIREMENTS (cont'd)

C. Flow Charts

In this section flow charts of selected functions are presented. They Include:

1. Valuation Subsystem or Appraisal Subsystem

This flow chart shows the main components of the mass appraisal process using the three approaches to value.

2. Analysis Subsystem

The supporting analysis activities for the mass appraisal subsystem are contained in this flow chart.

3. Administration Subsystem

The basic flow of the admininstration aspects of the system is given here.

4. Cost Module

This flow chart shows the detailed step-by-step process for the Cost Module.

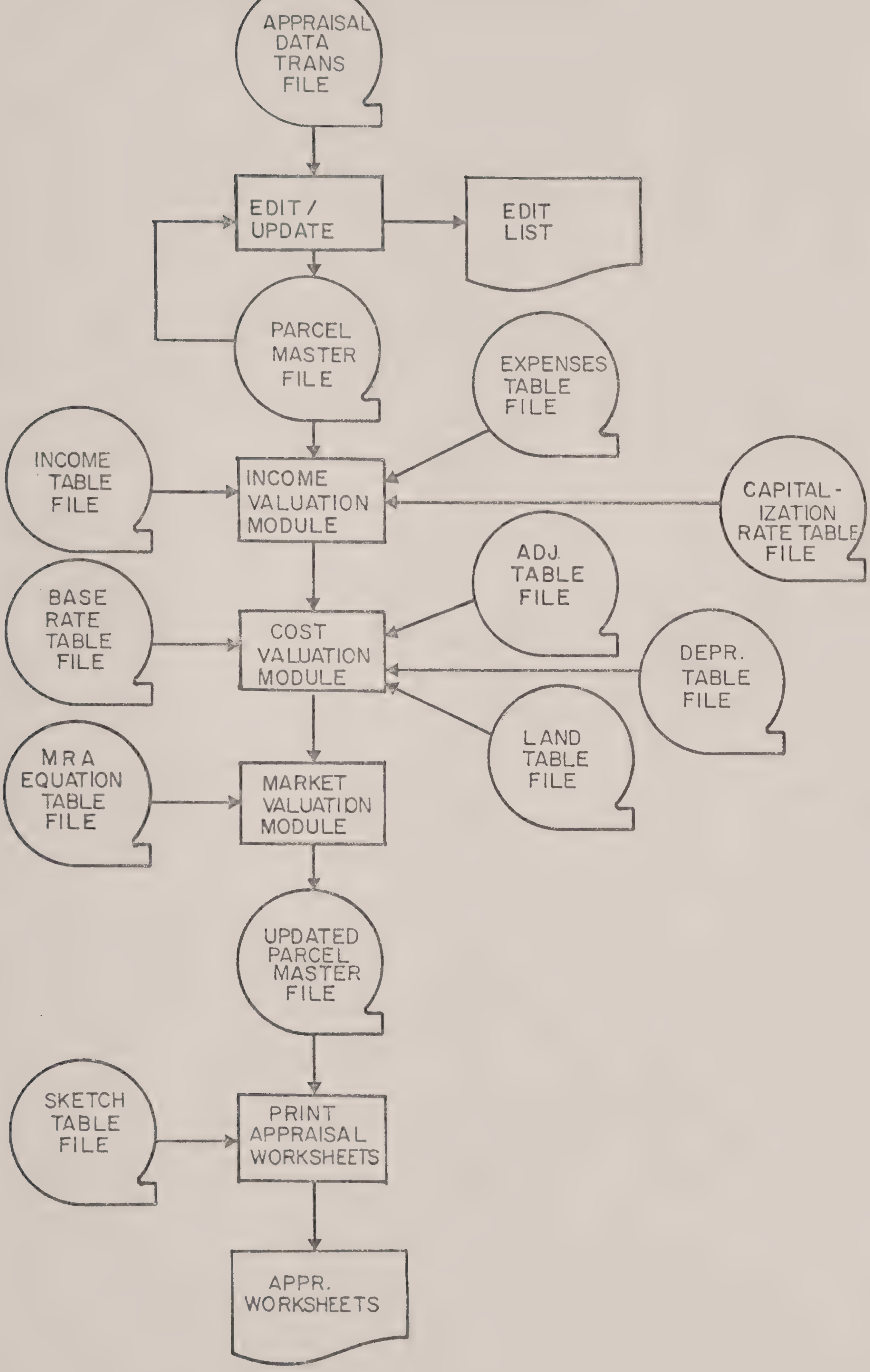
5. Market Module

This flow chart indicates the step-by-step process for the process for the Market Module

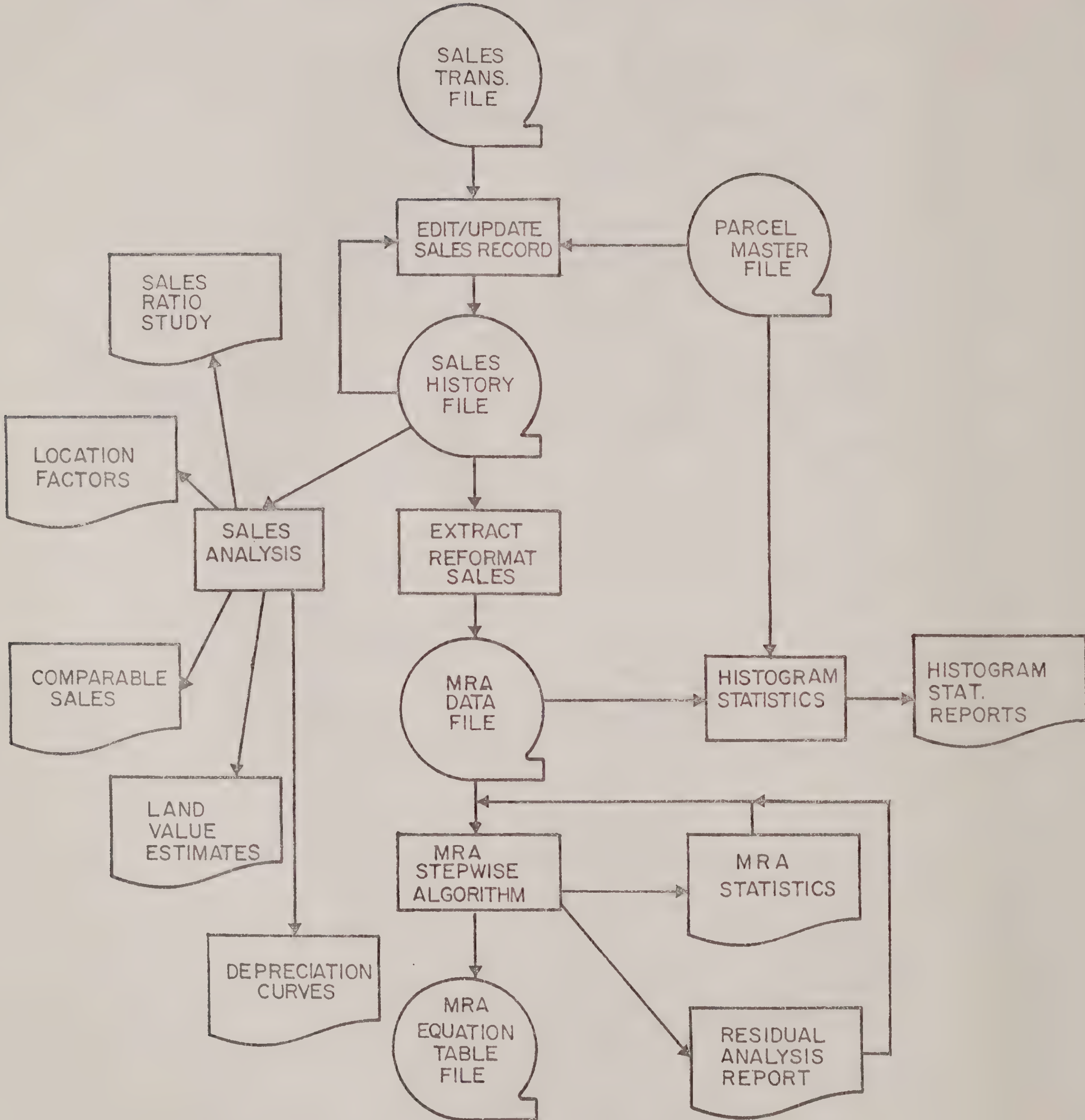
6. Income Module

This flow chart indicates the step-by-step process for the Income Module.

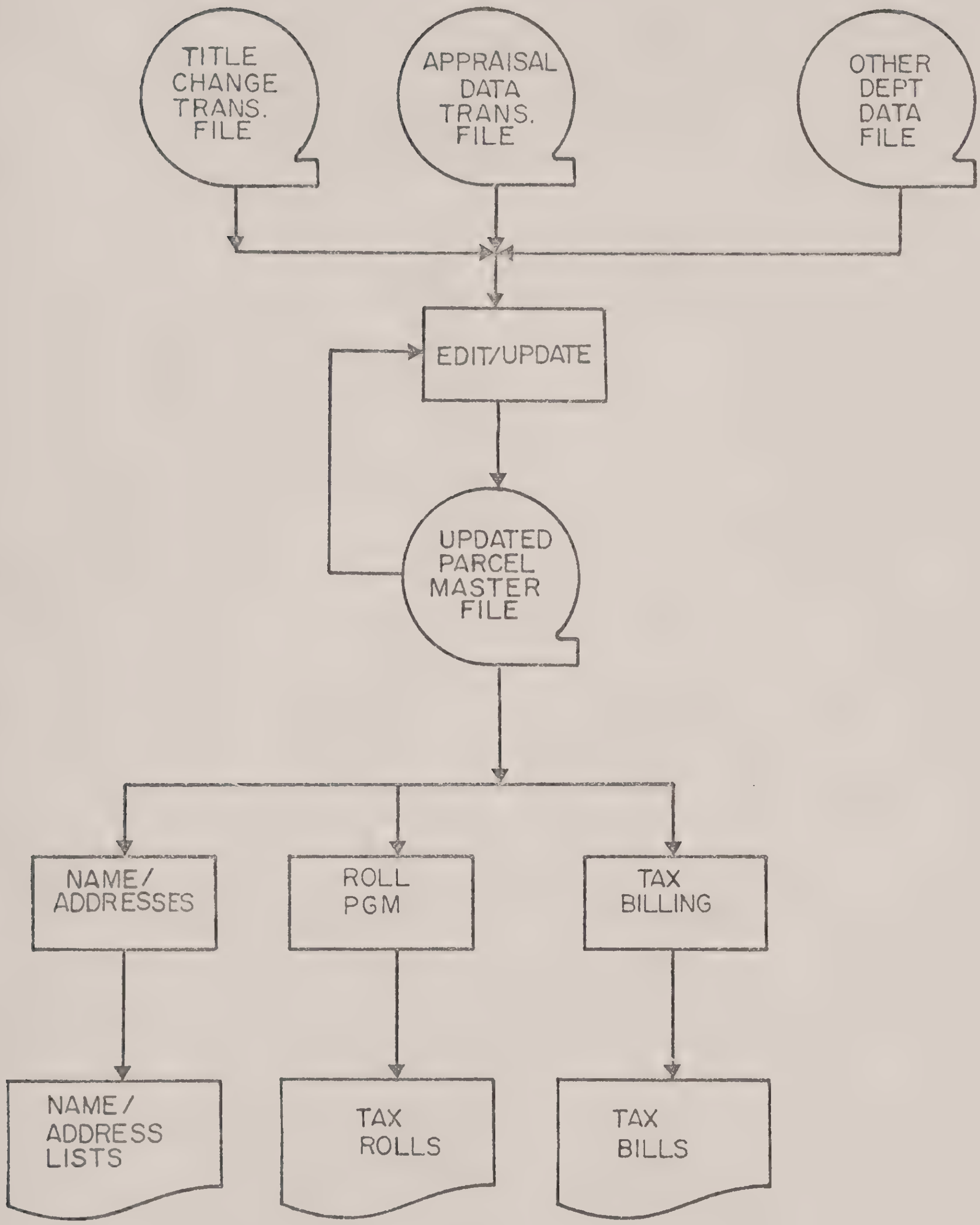
APPRAISAL SUBSYSTEM



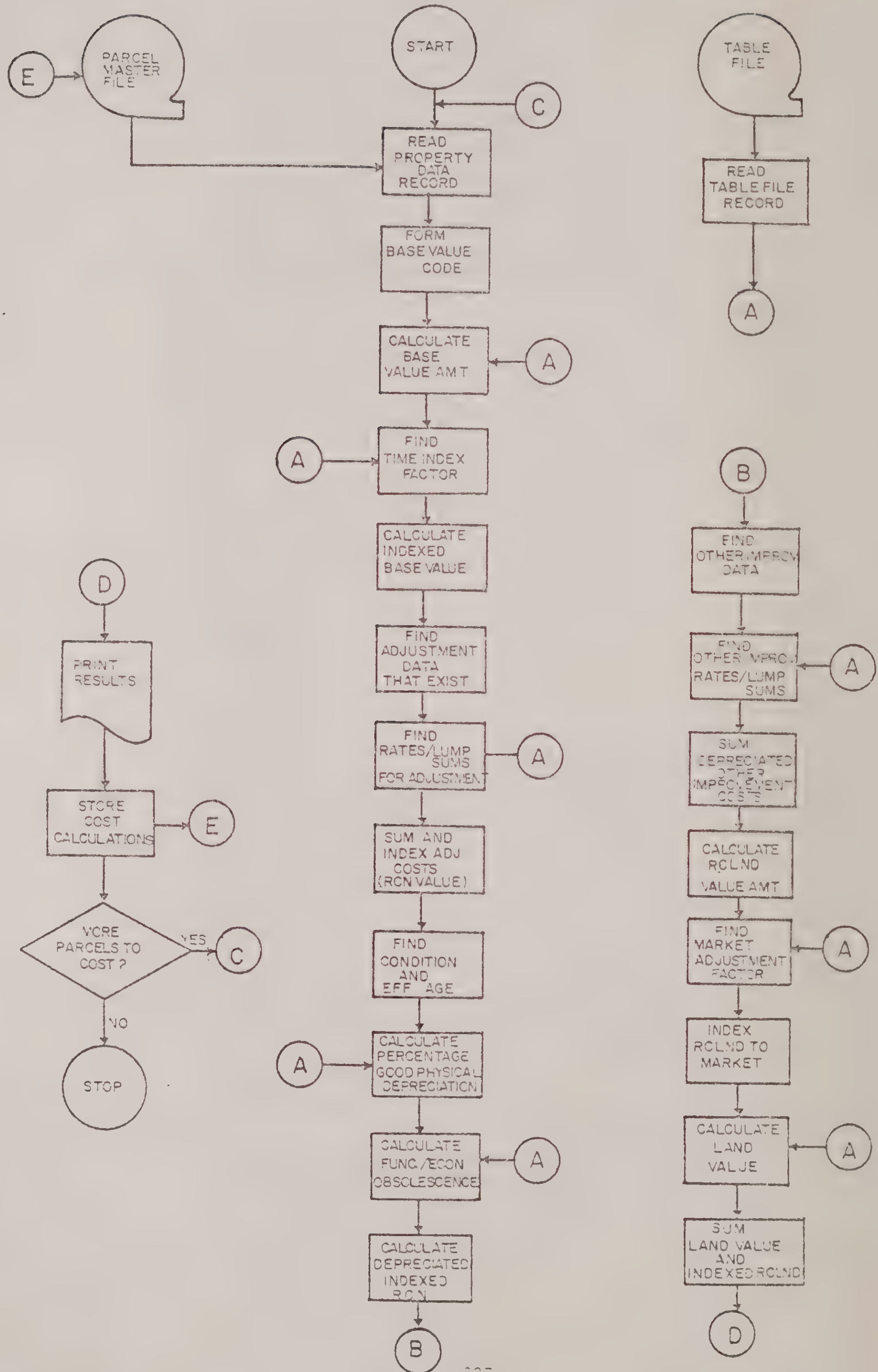
ANALYSIS SUBSYSTEM



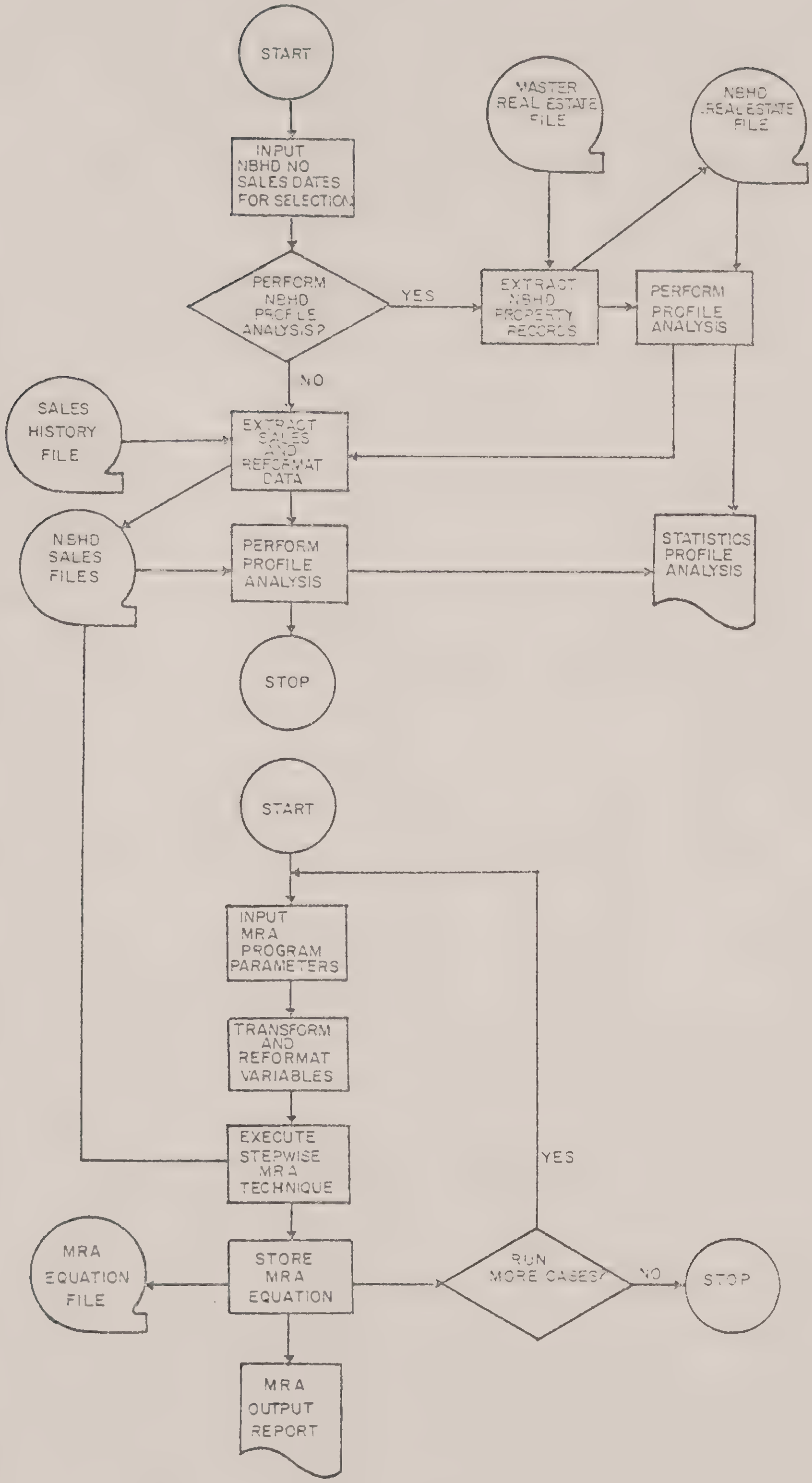
ADMINISTRATION SUBSYSTEM



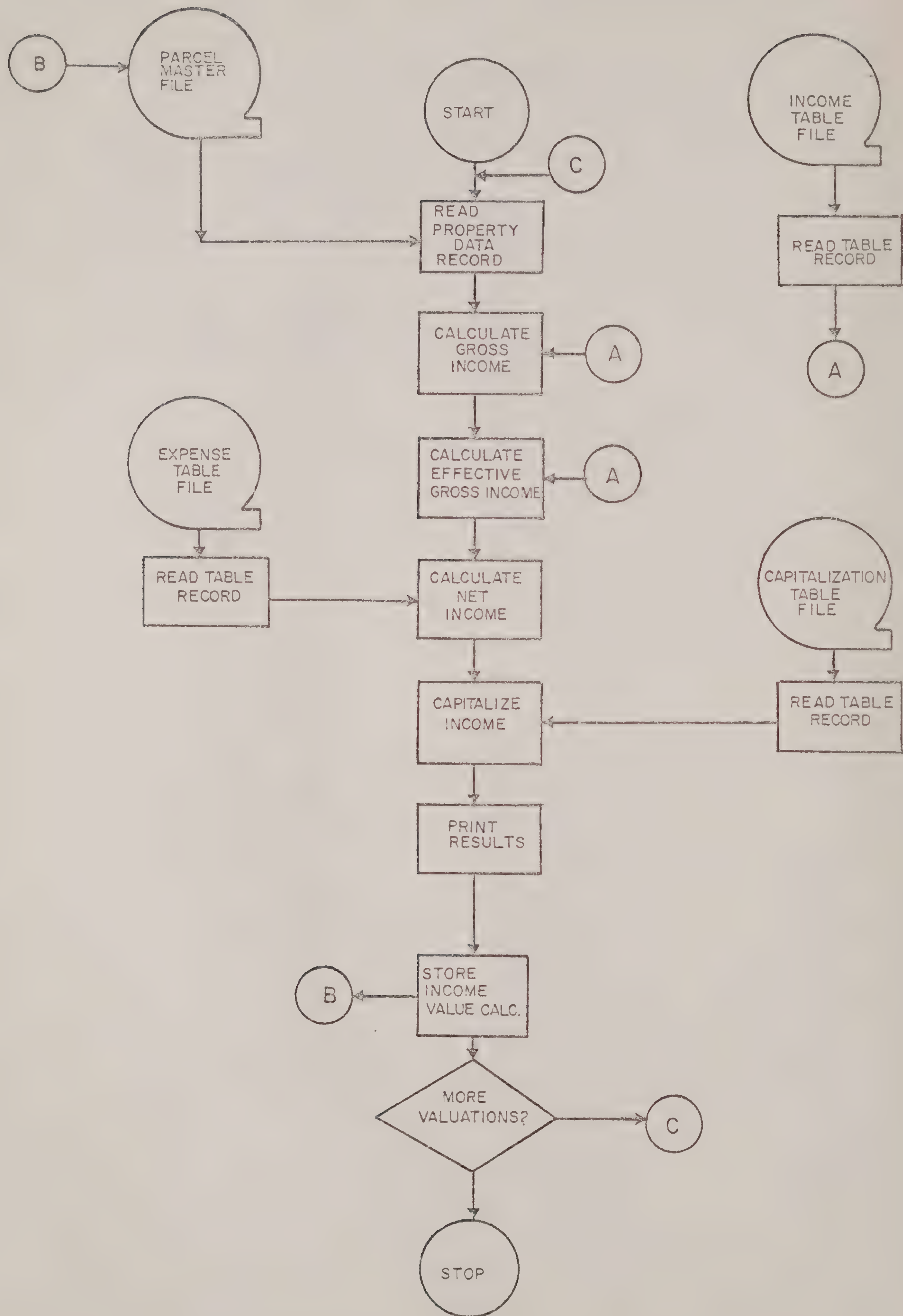
COST MODULE FLOW CHART



MRA MODULE FLOW CHART



INCOME MODULE FLOW CHART



III ADDITIONAL SYSTEM DESIGN CONSIDERATIONS

To date, the technical automation effort within the Equalization System has focused on:

(1) Identifying a framework for developing automated support for the mass appraisal system

(2) Developing a functional description of the automated system when it is fully developed and operational.

These efforts have been described in Sections I and II of this Chapter. In addition the technical effort has begun to address a number of important automated system design considerations. These include:

A. Data Integration Strategy

B. Software Development Strategy

C. Hardware/Software Configuration

D. Data Organization

E. Parcel Identification Number

F. Interface with Assessor's Tax Maps

G. Interface with Suffolk County Registry of Deeds Records.

A. Data Integration Strategy

A clearly defined data integration strategy needs to be developed. The Equalization effort will require the collection, assimilation and processing of over ten million distinct data elements. These data elements will be collected from the following sources:

(1) The existing Automated Real Estate Billing and Accounts Receivable System, (2) Manual records within the Assessing Department, (3) Manual records within other departments, notably the City Building Department and Suffolk County Registry of Deeds. (4) A major field Data Collection Program expressly for Equalization. The process of integrating data from previously separate operations must include consideration of data accuracy, data organization (e.g. how the data can be indexed), and data updating frequency. The data

collection strategy developed must also address:

(1) The data collection activities required for initially loading the data files and (2) the data collection activities required for the timely and efficient updating.

B. Software Development Strategy

The Automated Equalization System, as functionally described in this chapter, will require substantial software development. How the automated system's software will be acquired, is itself a major system design decision. The major alternatives for acquiring such software are: (1) Procuring commercially available application software. (2) Dedicating in-house application programmers and analysts to the Equalization effort. (3) Contracting application software consulting firms to develop software. Each approach has relative time, cost and resource considerations. The system software will probably rely on all three alternatives to some extent.

C. Hardware/Software Configuration

The exact computer configuration, a major component of the system design, has yet to be devised. It has been presumed the Automated Equalization System will reside in the City's main computer, an IBM 370/158. (The existing Real Estate Billing System, which is operated and maintained by personnel from both the Assessing Department and Central Data Processing Unit, resides on this system). However, before a final decision on hardware can be made a determination of impacts on the IBM 370/158 must be made. New required components, including disk storage devices, additional central processor partitions, telecommunications devices and peripherals, must be identified. Hardware analysis should include comparisons of several hardware configurations to determine if significant cost reductions could be gained by utilizing newer technologies.

With regard to software, a major decision concerns the balance between on-line and batch processing. A detailed delineation of system processing must be undertaken. The delineation of processing parameters should include: input vs. output, single account vs. multiple account, table file vs. data file, single query vs. summary report, immediate response required vs. delayed response, and separation by user groups (i.e. management, operations, public).

D. Data Organization

The major data organization decisions include: (1) The aggregation of data elements into distinct files, (2) The index capabilities (keys and access methods associated with each file). (3) System software support of data organization management. The aggregation of data elements into files is substantially completed. The files, e.g. Sales History File or Parcel Master File, are defined largely by logical and administrative considerations. The identification of data elements for valuation purposes has been thoroughly researched. However, additional elements, as internal keys and codes, must be developed in conjunction with the Equalization System software.

E. Parcel Identification Number

The parcel identification number is <u>the</u> single most important identifier in assessing administration. The City of Boston Assessing Department has for some time used a parcel numbering system for uniquely identifying property. There is a consensus that the existing numbering system may not continue to perform adequately in the new Equalization System. In some sections of the City the existing numbering scheme is running out of numbers. Also, the increasing trend towards condominiums results in significant number changes. Consequently a new parcel numbering system suitable for the proposed Equalization System is recommended.

F. Interface with Assessor's Tax Maps

The system design must incorporate some interface with the City Assessor's Tax Maps. The tax maps are the historical starting point in any municipal appraisal effort. The linkage between Boston's tax maps and parcel lists definitely needs to be strengthened. There are several cogent points to consider: (1) The existing maps are not uniformly updated. (2) The maps do not uniformly carry parcel numbers to uniquely identify each parcel. (3) The entire City is not recorded on parcel level maps. (4) As stated above, the existing parcel numbering scheme may change in the near future. Specifications for a new mapping effort have been recommended. (See Addendum). Also, an independent evaluation of the tax maps is presently underway.

G. Interface with Suffolk County Registry of Deeds

In July, 1978, the Register of Deeds, in conjunction with the Office of Property Equalization, requested Federal funding (HUD) for a project that would substantially improve Registry information processing. This project, which recommended the automation of numerous manual practices, would also substantially improve the timeliness and accuracy of sales information to the Assessing Department. Unfortunately, Federal funding for the project was not granted. However, substantial analysis of the Registry-Assessing interface was undertaken and should be incorporated into the system design. Recognizing that cost is the major constraint in fully developing a strong interface, consideration should also be given by the Office of Property Equalization to identifying other sources of Federal funding support

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CHAPTER FOUR - DATA COLLECTION

General Overview of Data Collection

An effective Data Collection effort is vital to the overall success of the Equalization Program, for the information collected during this effort will be the "raw material" that all other elements of the program will process. It is crucial that the Data Collection effort be organized in the most efficient manner, be meticulously accurate in the compiling of data, and that in this process, the public be treated in a courteous, businesslike, and even-handed fashion. A mass appraisal system may be expertly designed in all its phases and still never become fully implemented if this phase is not executed properly.

Another consideration in preparation for a data collection program is that it is an ongoing process. The initial equalization effort in Boston will require visiting each and every parcel in the City for purposes of data collection. After the initial effort has been completed, data collection will be needed, but only for new construction and demolitions.

The following sections will set forth recommended procedures for the implementation of a Data Collection Program:

Neighborhood Delineation

Field Operations

Quality Control

Phase Delineation For Implementation

1. Phase I: Neighborhood Delineation

A. General Overview of Neighborhoods

There is a need to delineate neighborhoods because of the effect that economic, political, and social forces have on real estate values. An identical property (in terms of physical characteristics) in one part of Boston may have an entirely different value in another section of the city. The real estate market establishes differential values for similar properties in different geographic areas. This market differentation is termed "locational influence."

There are many reasons for locational influences on property values. Within a given area, many of the existing properties may have been constructed at about the same time. There will, therefore, be a certain physical conformity among properties of the same general property type (i.e. residential, office space, etc.).

Political forces, such as the actions of local, state and federal agencies may affect real estate values and contribute toward the formation of neighborhoods. Government housing projects such as urban renewal areas, FHA 235 single-family or FHA 236 apartment complexes, may create areas where real estate values will tend to coalesce. The current trend toward residential renovation and home ownership in inner city areas creates new locational influences or new neighborhoods. These actions in the private sector are often initiated after a city has embarked on a beautification program or created a new park or some other project designed to make a specific area more attractive to a specific segment of the population. These political or governmental forces are not always directed toward the residential sector. Industrial parks may be generally located in a particular geographic area as a result of zoning or other governmentally initiated land-use programs.

Specific geographic and physical boundaries may serve to establish a neighborhoods. Railroads, turnpikes, rivers, major streets or highways may all separate one area from another in terms of the appeal to a specific segment of the real estate market.

It should be noted that the term "neighborhoods," does not specifically refer to residential neighborhoods. Areas may be delineated where industrial properties have created an "industrial neighborhood". Different areas may have an advantage over others from a technical standpoint. There may be amenities available to a specific type of employee such as available housing, recreational facilities, etc. which may influence where an industry locates. The availability of transportation facilities, such as highway, rail spurs, and navigable water ways; as well as public utilities, such as the amount of electric power available, the number of existing water lines for required levels (per gallon per hour) and the available sewage for waste disposal from plant production all contribute to the formation of "industrial" neighborhoods.

The purpose, then, of neighborhood delineation is to identify general areas or "neighborhoods" where the various forces (economic, social, physical, political) affecting property values are such that some degree of homogeneity will be established. It is a certain similarity in the market reactions of property owners which produces the corresponding homogeneity in ownership and construction types that creates a neighborhood.

B. Specific Tasks in Neighborhood Delineation

Since an initial neighborhood delineation is recommended below, the individual tasks described within this section are designed to improve analysis based on the recommended delineation and to provide the capability for altering these neighborhoods as market conditions change. The specific tasks for delineation of neighborhoods are as follows:

1. Review Available Data Sources.
2. Define Neighborhood Boundaries.
3. Neighborhood Areas.
4. Establish Systems Interface.

1. Review Available Data Sources

In order to initially establish neighborhood areas, data sources which may provide pertinent information should be identified and researched. These might include the following:

a. Boston Redevelopment Authority

Any publications or studies which have been initiated by the BRA should be researched. An example is the 1977 study entitled "District Profile and Proposed 1978-1980 Neighborhood Improvement Program". This study formed the basis for documentation and delineation of the specific neighborhoods which are recommended elsewhere in this report. Other studies concerning particular property types, land use options, housing market trends, economic base, etc. should also be reviewed.

b. U.S. Census Data

Publications of the U.S. Census Department contain valuable information related to population, income and specific areas. These "census tracts" are geographically defined areas for which numerous statistics are available. These are contained in computer files ("DIME files") which may be accessed by an existing system, given the adaptability requirements between system machines.

c. Existing Real Estate Market

The existing real estate market should be analyzed to locate areas of homogenity of property type and corresponding market values. Estimates of mean (average) sales prices of property types within various areas will indicate where the "market" is differentiating neighborhoods. (from a general viewpoint). General market interpretations may be combined with other research in providing the totality of data needed for the final establishment of neighborhood boundaries.

2. Define Neighborhood Boundaries

Once the data concerning real estate prices, population, economic bases, etc. has been accumulated, a decision must be made as to the exact location of neighborhood boundaries. These boundary lines will usually coincide with either established street or rail systems, or with natural boundaries such as rivers, lakes, and oceans. The description of the specific boundaries should be in documented form, with narrative and map delineation.

3. Parcel Aggregation of Neighborhoods

Once the neighborhood boundaries have been established, the next task involves delineating these boundaries in a computer accessable form for:

a. Assignment of Neighborhood Numbers

b. Assignment of Parcels to Neighborhoods.

a. Assignment of Neighborhood Numbers

Each specific neighborhood should be assigned a unique identifier. These neighborhood identifiers are referred to in other sections of this report as "N_1, N_2, $N_3 \ldots N_n$."

b. Assignment of Parcels to Neighborhoods

Since the entire City of Boston will be divided into neighborhoods, every parcel within the city will fall within one of the neighborhoods. Each parcel of real estate will have to be identified by keying its unique parcel identification number with its neighborhood number.

4. Systems Interface

The continued monitoring of neighborhood delineation (also discussed in the Quality Control subsection) is accomplished, in part, by reviewing data from the market analysis and performance analysis sub-systems. Specifically, data are separated into various stratafication within that section and will be available, complete with statistical analysis, by neighborhood number for property types and property grades. In addition, sales ratio data will be available by neighborhood, type, etc.

The systems interface will be a manual process in which the Analytic Unit, will review the statistical reports generated by the performance analysis and market analysis subsystems.

C. Recommended Neighborhood Delineation

It is recommended that the delineation of neighborhoods for the City of Boston will be accomplished through the use of a series of studies made by the Boston Redevelopment Authority and published in 1977. These identified nineteen districts within the city and smaller neighborhoods within these districts. The studies are entitled "District Profile & Proposed 1978-1980 Neighborhood Improvement Program", and are part of the BRA's Neighborhood Planning Program.

These districts are presented below in outline form, then in detail in the Addendum with maps and descriptions reproduced verbatim from the BRA publications.

It is the opinion of the consultants that the analysis concerning population, employment, housing stock, income levels, etc., is sufficient to initially define neighborhoods which are of a homogeneous nature. As the equalization program progresses, these neighborhoods will probably be redefined if ongoing analysis indicates that the initial neighborhood boundaries are not accurate or are changing. The 19 Districts are as follows:

1. Allston - Brighton District
2. Back Bay - Beacon Hill - Bay Village District
3. Charlestown District
4. Chinatown - South Cove District
5. Dorchester/Fields Corner District
6. Dorchester/Uphams Corner District
7. East Boston District
8. Fenway - Kenmore District

9. Franklin Field District

10. Hyde Park District

11. Jamaica Plain District

12. Mattapan District

13. Mission Hill/Medical Center District

14. North End/Waterfront District

15. Roslindale District

16. Roxbury District

17. South Boston District

18. South End District

19. West Roxbury District

2. Phase II: Field Operations

A. General Overview

"Field Operations" refers to the field collection of data on individual properties by data collectors. These collectors must accumulate the data which will eventually be processed in the Valuation Models to produce property values. Field operations constitute a large portion of an initial equalization effort, and are a vital component of the ongoing system, since once equalization has been achieved, it must be maintained.

Field operations are, therefore, a continuous process which, once initiated, will carry on as long as the taxing jurisdiction plans to maintain a current effective program of valuation. As with any mass appraisal system, there should be adequate planning and organization prior to actually sending teams of data collectors into the field. This process is described below.

B. Specific Tasks Involved in Field Operations

There are four specific tasks involved in planning and executing an efficient field operations program:

1. Organization of Personnel for Field Operations
    a. Data Collection Coordinator
    b. Area Supervisors
    c. Crew Chiefs
    d. Data Collectors
    e. Data Verifiers
    f. Inventory Control Clerks
    g. Audit Control Teams
2. Measuring and Listing Guidelines
3. Equipment
4. Training

1. Organization of Personnel for Field Operations

The amount of personnel resources involved in a data collection program is a function of the amount of data to be collected and of anticipated production levels. There are 95,664 parcels plus approximately 10,000 exempt properties for a total of 105,664 parcels of real estate in Boston (1978 figures). As illustrated below, classes of properties have been stratified for the purpose of converting all parcels to a common measure, the "standard parcel". This is a measure of the degree of difficulty in the measuring and listing process. For example, it will take approximately five times as long to capture data on R4, RC, CO, C, D Classes of property as it will on Classes R1, R2, R3. The "standard parcel" count for each category of classes ranges from "1" to "10".

Class	Parcels	1978 Number of Standard Parcels	Total Number of Standard Parcels
R1, R2, R3	1	67,227	67,227
R4, RC, CO, C, D	5	16,061	80,305
1	10	969	9,690
L	1	11,404	11,404
Exempt	7.5	10,003	75,023
		105,664	243,649

Our best calculations indicate that the time phase for this project will be two years, representing 730 calendar days in phase (CDP). The Daily standard production level (SPL) for one field lister is 10 standard parcels per day and due to weekends, holidays, illness, and inclement weather, the number of standard working days per year (SWD) is 203. Based upon these assumptions, the number of Data Collectors for field listing can be determined by the following formula:

$$P \times SPL \times SWD \times (CDP/365) = SP$$

Where:

P = Personnel Required

SPL = Standard Production Level

SWD = Standard Working Day

CDP = Calendar Day in Phase

SP = Standard Parcels

$$P \times 10 \times 203 \times (730/365) = 243{,}649$$

$$4060\,P = 243{,}649$$

$$P = 60 \text{ Data Collectors}$$

The personnel requirements of the Field Collection effort along with the appropriate job descriptions follow:

Title	Number
a. Data Collection Coordinator	1
b. Area Supervisors	4
c. Crew Chiefs	12
d. Data Collectors	60
e. Data Verifiers	10
f. Inventory Clerks	3

a. Data Collection Coordinator

The Coordinator is responsible for the supervision of the entire collection effort, and reports to the Director and Deputy Director as described in Chapter VI.

b. Area Supervisors

The Area Supervisors are responsible for the control of all property record cards in the field, for assignment of personnel, and for review of work completed. Property Record Cards are accounted for by using an Inventory Control Sheet, to be discussed later. When the order in which the neighborhoods to be visited is determined, the Area Supervisor assigns specific map areas to each crew chief and signs over the alloted number of property record cards (PRC) which should be completed by each respective crew before the end of that working day. The Area Supervisor will be responsible for the personnel management of his respective data collection crews. He is also responsible for field collection on "call-backs" where property owners are not at home. There will be four (4) Area Supervisors.

The areas to be visited should have advance notice that data collectors will be in the area. Publicity explaining that data gatherers will be measuring properties and checking property components is advisable in order to assure proper reception by the public. The Police Department should also be notified of the daily schedule of the Data Collectors.

c. Crew Chiefs

Under the four Area Supervisors are twelve (12) Crew Chiefs. Each crew is composed of five (5) data collectors. The Crew Chief reviews the area assigned to him, assigns the parcel workload, and gives the respective PRC's to each of his five data collectors for completion. He oversees their operation, assisting with any problems. At the end of each work day, the Crew Chief collects the PRC's that were handed out that morning and makes the assignments for the next day, in terms of location and time. After he has the completed cards, he returns to the central office and checks in all returned cards on the Inventory Control Sheet. The Crew Chief then prepares the next day's work, notes areas to be covered on the map and signs out (on the inventory control list) the PRC's which will be used on the next day. With this procedure, he may return directly to the field the next morning with instructions and PRC's for his crew.

d. Data Collectors

The Data Collectors are the people who actually measure the improvements and list the property characteristics on the PRC for every building in the City. In addition to the training program described below a substantial orientation program regarding relationships with the public should be conducted.

e. Data Verifiers

There are ten (10) Data Verifiers associated with the Field Operations. They are office personnel whose responsibility is to check the PRC's which have been turned in for any possible ommissions or errors. The verifiers must specifically review an average of sixty (60) PRC's per day, checking all entries.

f. Inventory Control Clerks

There are three (3) Inventory Control Clerks. These Clerks are responsible for logging in and out all PRC's. The Inventory Control Clerks notify the Data Collection Coordinator of any unreturned PRC's or of any irregularities related to the security of the records. These clerks check out the PRC's to the Area Supervisors each day (on the average 600 PRC's are checked out each day). During the day, the clerks prepare the six hundred cards for the next day in bundles of 150 records with a colored paper separater inserted between each 50 cards so that the area supervisor may easily divide the PRC's among his three Crew Chiefs. The PRC's must be in map-order so that the Data Collector finds his cards numbered in the same order as the properties to be measured and listed. The average number of Records (PRC's) handled by each person involved in the Field Operations is as follows:

Title	Number Persons	Records Per Person Per Day	Total Records Processed Per Day
Area Supervisor	4	150	600
Crew Chief	12	50	600
Data Collector	60	10	600
Data Verifier	10	60	600
Inventory Control Clerk	6	100	600

In addition to preparing PRC's for the area supervisors for the next day, the Inventory Control Clerks must re-file the completed cards which have been returned to them by the Data Verifiers.

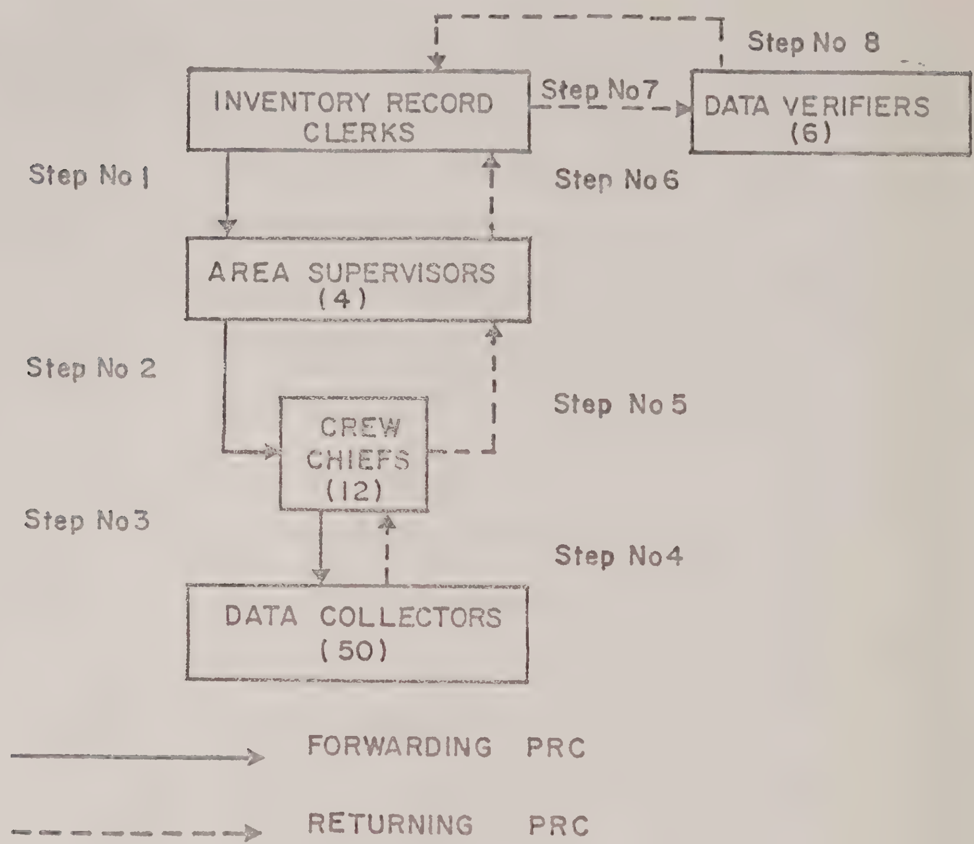
<u>Note on Inventory Control and the Property Record Card</u>

Inventory control refers to a systematic recording of the exact location of every individual Property Record Card (PRC). Inventory control assures against loss of PRC's, whether complete or incomplete. The key to the success of inventory control is two-fold: first, a computer print-out by map number is used as a master checklist. As cards are removed for field listing and signed out by the Area Supervisors, the master list is color coded: red for "out", green for returned. This is in addition to a posting on the Inventory Control Sheet.

All PRC's removed by the Inventory Control Clerk are checked on the master list and signed for by the Area Supervisor. Any cards returned which do not appear on the list should be added to it. This might occur if, for some reason, a parcel was not on the list and was located during the field canvass. When this occurs, a data processing slip should be prepared so that proper entry may be made. If a record is discovered to be missing, the Inventory Control Clerk immediately notifies the Area Supervisor and the record must be located. All PRC's must be accounted for at the end of each working day. If anyone wants a PRC for reasons other than the normal checkout, the card desired should be copied and the copy given so that security is maintained. The flow chart shows the daily sequence to be followed in maintaing proper inventory control.

The importance of proper inventory control cannot be overstated. If a record is missing, the tax base may be affected by the amount of the value of that property. This would not be as significant with residential as with commercial properties. Various types of records and forms will be utilized in the Equalization System. Emphasis has been placed on inventory control of the Property Record Card because of the inherent importance of this record. The Property Record Card is the basis of the proposed Master Parcel File. This record will contain the complete data base for individual properties and for that reason deserves the highest degree of security.

INVENTORY CONTROL: PROPERTY RECORD CARDS



Step # 1. PRC checked out to Area Supervisor (150 each)

Step # 2. Area Supervisor Assigns PRC's to his Crew Chief (50 each)

Step # 3. Crew Chiefs assign PRC's to Data Collectors (10 each)

Step # 4. Data Collectors return PRC's to Crew Cheifs

Step # 5. Crew Chief checks for accuracy and returns to Area Supervisor

Step # 6. Area Supervisor checks for accuracy and returns to Inventory Record Clerk (and then signs for next batch)

Step # 7. Inventory Record clerks assign PRC's to Data Verifiers (100 ea.)

Step # 8. Data Verifiers check PRC's and return to Inventory Control Clerk

The Categories of information contained on the Property Record Cards are:

1. Property Identification Characteristics; name, address, and legal information. (Historic Data)
2. Physical Characteristics (Specific Data Elements)
3. Value Influencing Factors (General Data Elements)
4. Valuation (Cost, Market and Income Approaches)

Because of differing data base requirements, the formats for residential and commercial/industrial properties have been individually designed. However, with regard to purpose and function, the records are the same. Information items contained on the Property Record Card are discussed in detail in the Data Base Design section of this report.

Property Record Cards are designed as computer generated turn-around documents. The record will be pre-printed and produced by the computer system with all Property Identification Characteristics, ready for use in the Data Collection Program. Once the field data have been recorded, all data will be key punched directly from the record for storage in the Master Parcel File. The computer will then generate the completed document on paper copy for assessment office use. Space has been allowed for computer codes and appraiser entry. In the event of up-dates (e.g. new construction, land use change, etc.) the process will be repeated. Examples of the Property Record Cards are included as exhibits to this section.

g. Audit Control Teams

There will be two Audit Control Teams of two persons who will operate independently of the Area Supervisors and their data collection teams. The purpose of these Audit teams is to randomly sample and verify data which have already been collected by the data collectors. These teams will be responsible only to the Director, Office of Property Equalization.

The function of the Audit Control Teams, will involve three activities:

1. Assignment of Random Areas
2. On-Site Data Verification
3. Report to Director, O.P.E.

1. Assignment of Random Areas

The decision as to which areas and which specific properties are chosen for verification should be made independently of the Data Collection Division. The Analytic Unit established for statistical analysis will extract an accurate "random" sample of properties where data have been previously collected. This will insure that the results of the efforts of the Audit Control Teams are, in fact, representative of the overall data collection program.

2. On-site Data Verification

On-site verification involves taking copies of previously completed property record cards to the site of the property involved and physically checking each entry. Through this process, items which are being consistently collected erroneously may be identified and corrected. This process also serves to further document the integrity of the overall data collection process.

3. Report to Director, O.P.E.

Upon completion of an audit survey within a particular neighborhood, the Audit Control Team must prepare a report on their findings for the Director. A copy of this report will also be sent to the Analytic Unit which chose the random samples. The Analytic Unit will also prepare reports, by neighborhood. The reason for the reports at all levels is to, again, insure integrity in the audit process and the analytical process. Severe damage could result in the equalization process if decisions or erroneous conclusions were made without the corrective results of the audit control team efforts.

2. Specific Tasks in Field Operations: Measuring and Listing Guidelines

a. General

The actual measuring and listing is done by the data collector. He is equipped with a map of the area, a clip board, PRC (property record card), and a 100 foot tape measure.

b. Personal Introduction and Explanation of Purpose

The collector should present proper credentials to the owner, noting his position, a photograph, and telephone number of the central office where someone can be reached to verify identities. The collector should be courteous, explain his purpose and ask the owner's permission to make an inspection.

c. <u>Exterior Inspection</u>

The Data Collector begins his exterior examination as he approaches a building. He will note on the PRC the architectural design, the construction type (eg., wood frame, masonry) the type of exterior wall (eg. Stucco, wood siding, brick veneer, etc.), the number of stories (eg., 1 story, 1½ story, 2 story, etc.), the roof type (eg. mansard, gambrel, flat, gable, hip, etc.), the roof material (eg., asphalt, shingle, slate, wood, etc.), number of chimneys, number of garages (and type: attached, detached, number of car spaces), and any other exterior features. Photographs should be taken of any unusual features which might require verification later, such as extremely poor conditions, chimneys falling apart, new renovations, etc.

Measurements of the building should then be taken by measuring the exterior walls and making a sketch on the PRC as measurement proceeds. Upon completion of measurements, the collector should check opposite sides of the building to make sure that the sides are of the same length. Next, the square footage of the improvements should be calculated. These will be re-calculated by office personnel to aid in avoiding errors. Any special exterior features such as porches, patios, retaining walls or other buildings should be measured and checked at this time. Also, any problems such as cracks in the walls or unusual settling in the foundation should be noted.

d. <u>Interior Inspection</u>

Once all exterior notations have been made, the data collector should knock on the door again and ask (in the same courteous manner) to be allowed to make the interior inspection.

The interior inspection should begin in the basement. If no basement exists, the collector should go under the house in the crawl space.

In the crawl space the collector should note materials used in the foundation, the type and condition of structural parts, the type of beams or girders - (i.e., 2" by 10", 2" by 12" lumber or steel "I" beams), the size and spacing of the floor joists for the the first floor - (i.e., 2" by 8" 2" by 10" or 2" by 12" lumber, 16" on center or 24" on center).

The type of basement floor and floor covering should be noted. Mechanical equipment such as furnace, hot water heaters, air conditioning, laundry, type of electrical service, and general plumbing features (first floor toilets may be counted by noting the number of drain pipes). If there is living area in the basement, the collector should note the size, type of materials, number of bathrooms, and the condition. Much of the overall quality of the house can be determined through a thorough examination in the basement or crawl space under a house.

Inspection of the main floor is made next, beginning with the general features of the home, type of wall and ceiling finish, floor finish, special finish in the kitchen or bath (i.e., dry wall or plaster), type of floor covering (i.e., hardwood, carpet, vinyl, etc.), and any built-in items (i.e., range, fan, disposal, dishwasher, ceramic tile, special bathroom fixtures, etc). The upper floors should then be inspected in the same fashion.

Questions concerning office policy (valuation or otherwise) should be referred to the central office so as to avoid any possibility for heated discussions or disagreements. The Data Collector should leave the house in the same courteous manner he entered it, thanking the owner for allowing him into the house. After leaving the house, the collector should enter on the card the date of inspection, his initials, and double check the PRC for any possible entries which might have been overlooked.

e. Return Visits

If no one is home when the Data Collector arrives, he should leave a card stating the time, date, reason for the visit, and a telephone number where someone may be reached for an appointment. The Area Supervisor is responsible for "call-backs" at the owner's convenience.

3. Equipment

There is a minimum of equipment of which will be required in order to complete the Field Operations. Portable filing drawers will be needed by the Area Supervisors for storage of PRC's and maps. Rulers, with 10 graduations to the inch, should be available for all area supervisors, Crew Chiefs, and Data Collectors. All Data Collectors, Crew Chiefs, and Area Supervisors should have 100' measuring tapes (preferrably cloth, not metal), and surveyors pins for measuring buildings. Each field person should have portable calculator for computation of square footages. Everyone associated with any field work should have an identification card with photograph for proof of identity. Each Crew Chief should have an inexpensive instant camera to be used for problem situations and later evidence. Every Area Supervisor should have a two-way radio.

The chart below summarizes the basic equipment needs:

ITEM	Area Supervisor	Crew Chief	Data Collector
I.D. Card	x	x	x
Measuring Tapes (100 feet)	x	x	x
Surveyors Pins	x	x	x
Rulers (10 graduations to inch)	x	x	x
Flashlights	x	x	x
Clipboards	x	x	x
Pencils	x	x	x
Portable Calculators	x	x	x
Cameras	-	x	-
Two-Way Radio	x	-	-
Portable Filing Cabinets	x	-	-

4. Specific Tasks for Field Operations: Training

A training program must be undertaken for all personnel involved in the Field Operations. Inclusion of all personnel insures that everyone will be fully aware of the nature of the program, and why and how it is being conducted. Since the public will view all personnel as being equally knowledgable concerning the program, it is vital to the credibility of the entire effort that all employees be able to give accurate and informed responses.

The training programs should cover basic appraisal principles, valuation procedures, office procedures, and data collection procedures. Separate training sessions should be held for Area Supervisors and Crew Chiefs. These should provide instruction in basic management techniques and supervisory methods. Slide presentations should be prepared for the Data Collectors which will illustrate the entire process of data collection on all types of property they will encounter. Sample PRC's should be filled out from observations on several structures illustrated with slides. The Inventory Control Clerks should be drilled in exercises with the Inventory Control Sheets and sample Master Lists. Data Verifiers should review all of the sample PRC's filled out by the Data Collectors. The Verifiers should be involved in filling out several forms also, as this will provide first hand knowledge of the form, and any easy-to-make mistakes (i.e., ommission of roof type or foundation type).

As with Inventory Control, the importance of an adequate training program cannot be over emphasized. An effective training program can decrease or eliminate possible errors which might otherwise occur repeatedly in the field.

5. Specific Tasks for Field Operations: Quality Control

Quality control is designed to assist in the overall implementation of field operations by providing checks on both progress and the quality of progress. Adequate Quality Control is an absolute necessity in implementing field operations.

The Quality Control which has been designed for the equalization program involves three specific areas:

A. Project Management Techniques

B. Quality Control of Neighborhood Delineation

C. Quality Control of Field Operations

Project Management consist primarily of instituting standard management policies, and developing progress reporting procedures. Quality Control concerning Neighborhood Delineation consist of statistical analysis of data produced for the Analytic Unit by the Market Analysis and Performance Analysis sub-systems. These subsystems are discussed in detail in the Valuation Models section of this report. Lastly, Quality Control of Field Operations deals with inventory control and audit procedures.

A) Project Management Techniques

The first step in project management is planning and organization. Once the overall plan has been established the next step is to establish written procedures for management control.

Key areas of management concern are:

1. Establish Planned Project Phases
2. Establish Personnel Needs
3. Establish Planned Monthly Production Estimates
4. Establish Project Schedule Chart
5. Check Actual Project Phase Progress
6. Check Actual Personnel Hiring and Placement
7. Check Actual Monthly Production
8. Chart Actual Daily Performance on Project Schedule Chart

1. Establish Planned Project Phases

A phase Delineation Chart, should be developed to show the anticipated phases of the Data Collection program. The chart should realistically project month by month and year by year the anticipated progress of the various stages encountered in the entire Data Collection effort.

2. Establish Personnel Needs

Personnel Level Estimates should be filled out with consideration for two factors:

a. timing of hiring

b. placement of personnel

a. Timing of Hiring

The point in time when personnel are "brought on board" and terminated or transferred into a different position should be determined as precisely as possible. One of the largest cost items encountered in an equalization effort is that of personnel salaries and associated costs (insurance, benefits, etc.). The administrator needs the capability of planning the timing of hiring so that personnel are hired only in time to receive any training necessary before commencing with their duties.

b. Placement of Personnel

Planning for the placement of personnel will actually take place in conjunction with planning for the timing of hiring. The largest demands for large numbers of personnel will be during the measuring and listing phase. This will not begin, however, until "Planning and Organization" have been completed (as they relate to measuring and listing). Therefore, personnel who will be involved in field data collection (measuring and listing) would not be hired until the timing was appropriate.

In hiring and placing personnel, care should be taken to see if a person may be continued as an employee after the project is completed. Several of the Data Collectors, for example, may be maintained as permanent "field property listers" for new construction occuring after the initial project is completed. Some of the personnel involved in Data Verification during equalization will be trained and may be utilized as office/clerical personnel.

3. Established Planned Monthly Production Estimates

Production Estimates should be projected on a monthly basis by the anticipated number of parcels or "records" which should be completed during each phase of the project. This allows the Administrator to see the projected progress on a monthly basis and view where the project should be at any given point in time.

4. Establish Project Schedule Chart

A Project Schedule Chart, should be developed to show the number of parcels anticipated to be completed (measured, listed, property record card filled out, verified and filed). This chart will provide a basis for later checking actual performance against planned performance.

5. Check Actual Project Phase Progress

Forms must be developed to record actual progress as the equalization program gets underway. Once recorded on the Project Schedule Chart, the Administrator may immediately view actual performance versus projected performance. If there is a variance between actual and projected, it is either because the initial estimates were unrealistic or there are problems with the manner implementation is progressing. The logic of the plan should be reviewed prior to initiating a lengthy process of problem solving in the field operations.

6. Check Actual Personnel Hiring and Placement

Actual Personnel Hiring and Placement should also be recorded for administrative review similar to the procedure described immediately above.

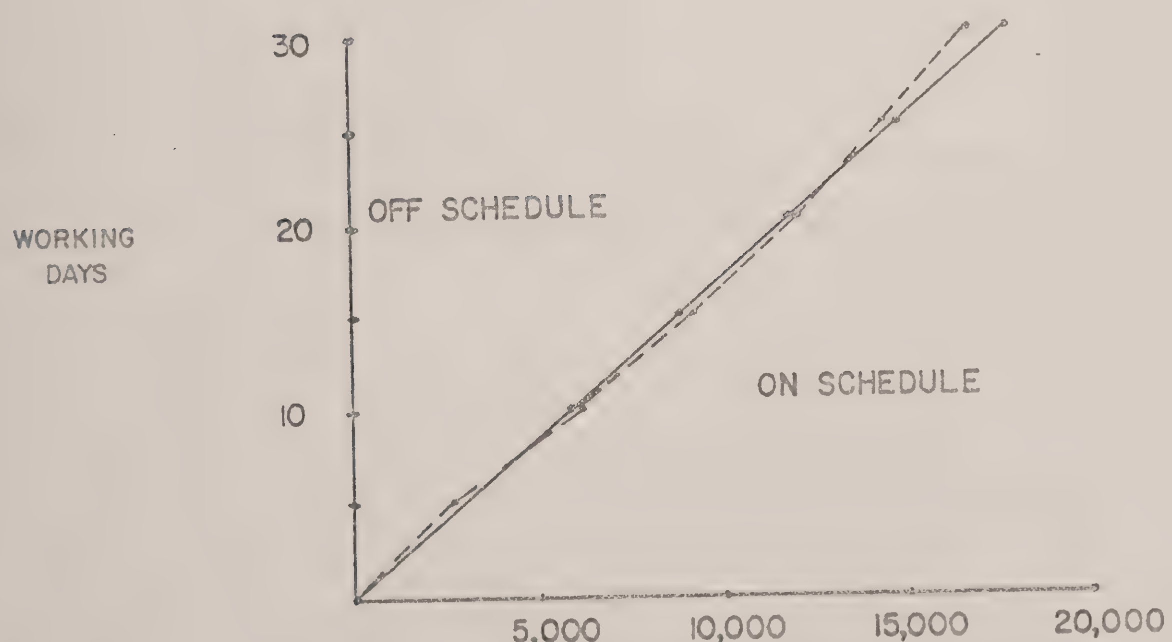
7. Chart Actual Daily Performance on Project Schedule Chart

This task may be accomplished by "over-laying" actual performance on the original projections shown on the following Project Schedule Chart. The advantage to this is that, on a daily basis, field performance may be monitored. Should a trend develop where actual data collection begins to consistently deviate from projected, the same actions suggested in the above paragraphs should be initiated.

8. Check Actual Monthly Production

Monthly production should be recorded and charted as discussed in step 7.

PROJECT SCHEDULE CHART



B) Quality Control of Neighborhood Delineation

Quality control of the delineation of neighborhoods involves a constant monitoring of the market and performance analysis portions of the system by the Analytic Unit.

Specific Tasks

More specifically the unit should review the following items:

1. Market Analysis Subsystem
2. Performance Analysis Subsystem
3. Census Tract Data

1. Market Analysis Subsystem

The Market Analysis Subsystem contains two specific items which will be of assistance in spotting possible changes in market reactions within a neighborhood. These are:

a. Locational Index Factor for Land
b. Market Adjustment Factor

a. Locational Index Factor for Land

This factor is calculated by dividing a computed land value by a sales price less RCNLD.

The formula is as follows:

L ÷ (S.P. - RCNLD) = Locational Index Factor

Where: L=Current Land Value (on record)
SP=Current Sales Price
RCNLD=Replacement Cost New Less Depreciation

Changes in this locational index which are not simple adjustments due to a rising market should be noted. The market analysis module does provide additional statistics on these indices by neighborhood. These may also be viewed as an inter-neighborhood as part of the anlaysis.

b. Market Adjustment Factor

The market adjustment factor is calculated by the following formula:

(SP - L) ÷ RCNLD = M.A.F.

Where: L=Current Land Value (on record)

SP=Current Sales Price

MAF= Market Adjustment Factor

This will tell the analyst what the Market Adjustment Factor is for any given neighborhood. These should be inspected for any unusual changes. Unusual or unpredictable changes may be an indication that market reactions are creating new neighborhood boundaries.

2. Performance Analysis Subsystem

The portion of the performance analysis subsystem which should be monitored by the analyst is the "Ratio Analysis by Location". This statistical report provides, for all neighborhoods, the mean and median ratios, coefficients of dispersion, standard deviations and other statistics. These should be monitored for unusual changes in the ratio levels. Shifts in ratio levels by neighborhood may be an indicator to the analyst that the characteristics of a neighborhood are altering. A sudden increase in the ratio level (without a change in assessments), would mean that for some reason values were declining in a particular area.

3. Census Tract Data

The data which are available after every U.S. Census, as well as any interim reports, should always be monitored. The data relating to population, income level, socio-economic data, etc. may provide the analyst with indications of change.

C) Quality Control of Field Operations

In order to process the large amount of data collected from the field operations, particular care must be taken in design of forms and records so as to maximize Quality Control (including Inventory Control).

The key form to be used in the data collection program and ongoing equalization system is the Property Record Card (Residential and Commercial). Just as tax maps are invaluable in the discovery of real estate, a system of property record cards is essential for the listing of the necessary data concerning each parcel of property, and recording the indicators and final estimate of value.

Property Record Cards, sometimes referred to as the "Street Cards", "Field Cards" or "Assessor's Cards" vary in design from one assessment system to another. A Property Record Card should provide for recordation of the following items:

1. Address and identification number of the particular property to be described.

2. Name and mailing address of owner, with date, volume, and page of deed of record. Space should be provided so that a number of transfers of ownership can be recorded on the same card.

3. Records of sales price, and in some cases, the mortgage on the property.

4. Data on size, shape, type, and condition of land. Frequently contrasting colored cards are used to differentiate between residential property, farm property, commercial and industrial property.

5. Land appraisal computations, showing the unit cost per front foot, square foot, or acre, as determined for that parcel.

6. Sketch of building drawn to scale, with all dimensions written in.

7. Detailed description of building, including year built, class and type (residence, commercial, industrial, etc.), number of stores, number of rooms, condition, and complete construction detail.

8. Where building permits are available, the appraisal card should contain space for the date, number, and type of the original permit and for subsequent permits, as the additions and alterations.

9. Computation of estimated reproduction costs and depreciation.

10. Where applicable, provision for recording income, expense, and lease information, and capitalization of income computations.

11. Notation of any factors affecting the value of the property, such as zoning or deed restriction.

Sample Property Record Cards for residential and non-residential properties have been designed for use in the Boston Data Collection Program. These proposed record cards may be refined prior to implementation. However, basic concepts incorporated in the form design should be preserved. Significant features of the Property Record Cards are as follows:

1. Field Card or Data Collection Card requirements and Front Office Public Record Card requirements have been combined in one oversized document. This document may be folded and filed in one central place, or separated with the Field Card being available only to assessing personnel and the permanent card being available for public inspection. Significant differences in these two formats are a. the Field Card is a complete display of the data base requirements and is identified with regard to name, address, and legal information only to the extent that will be necessary in field data collection requirements. b. the permanent record section of the Property Record Card gives only an abbreviated listing of the data base that applies to an individual parcel. An outline of the three approaches to value along with value conclusions are listed and a historical record of ownership by name, date, and sales prices is also listed.
2. The Record Cards have been designed for computer generation and will serve as a turn-around document. The original data collection card may be pre-printed and destroyed after key punch and verification operations. The "ongoing" Record Card

will be computer generated with space allowed for changes to be entered by the appraiser in the field and returned for direct key punch operations. As changes are made, the data base will be updated and a new Record Card will be generated.

3. The Record Cards are designed to be compatible with data base items required by the system.

Items contained on the Property Record Cards have been defined in the Data Base Chapter of this Report. The Residential and Commercial Property Record Cards designed for the City of Boston are shown in the Exhibit section of this Chapter.

Specific Tasks: Quality Control For Field Operations

The specific tasks involved in maintaining a high degree of quality control for the field operations involves two groups of personnel:

1. Field Staff
2. Audit Control Team

1. Actions By Field Staff

Quality control is maintained in the field by the supervisory level personnel, crew chiefs, area supervisors and data verifiers. The crew chiefs should check, randomly, the work of each of their data collectors. The area supervisors should likewise spot-check the records which are submitted by the crew chiefs. If checks at this level are random and consistent, quality control may be relatively effective.

The major role of the data verifiers is quality control, in that their function is to locate and correct errors which may have been made in the field. This requires them to note changes for return to the field, not to make actual changes.

2. Actions By Audit Control Team

The function and duties of the Audit Control Team have already been presented. Their duties, are also related to maintaining overall quality control. They are given random properties to inspect, and they operate independently of the entire field operations staff. This autonomy will provide even more assurance that every effort is being made to maximize the degree of quality and integrity of the equalization system.

Exhibit 1 - MONTHLY PRODUCTION ESTIMATES: This format provides for the planning and viewing of a parcel count of the anticipated progress of the mass appraisal. Based on allocated time and the number of available personnel, this chart enables the progress of the equalization process to be quantified. This allows the performance level (in terms of completion) to always be visable and calculable.

Exhibit 2 - INVENTORY CONTROL FORM: The Inventory Control Form is designed to allow the Inventory Control Clerks to know where all records are at all times. This form should serve to indicate whether or not records are returned as checked out. It indicates the checking out clerks name, folder number, map numbers, name of assignee's, signatures, and times in and out.

Exhibit 3 - CREW CHIEF'S CHECKLIST: BUILDING DIMENSIONS AND PROPERTY CHARACTERISTICS: This form is designed so that the crew chief may check the work of each of his Data Collectors, parcel-by-parcel. He must indicate the parcel number, whether the building was properly measured, and whether all building characteristics have been properly noted. This form is a double check prior to that which will be done by the Data Verifier.

Exhibit 4 - AREA SUPERVISOR'S CHECKLIST: This form provides a checklist for the Area Supervisor to record the assignments he has made of the folders checked out each day. He should indicate folder number, map numbers, crew chiefs assigned with "log-in" and "log-out" times and initials.

Exhibit 5 - WEEKLY AREA SUPERVISORS REPORT: This report provides the central office with the daily production progress on a weekly basis, as it was planned/assigned and as it was completed. Problem areas or problem workers will tend to become evident through these forms.

Exhibit 6 - MONTHLY AREA SUPERVISORS REPORT: This report provides a week by week look at the mass appraisal program's progress. These reports should be combined, and compared to MONTHLY PRODUCTION ESTIMATES. If the total project or portions of it are falling behind, this report will assist in readily identifying the problem.

Exhibit 7 - PROPERTY RECORD CARDS: These exhibits are suggested versions of cards which would contain data relating to property and improvements.

EXHIBIT 1

MONTHLY PRODUCTION ESTIMATES

Activity	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Planning and Organization													
Data Analysis													
Measure and List-Field													
Review-Field													
Land Value													
Calculation Office													
Final Review Field													
Final Review Office													
Update and Correct													
Hearings													

EXHIBIT 2

INVENTORY CONTROL FORM

_______________________________________ Date: __________

INVENTORY CLERK NAME

Assigned To: __________

Records Assigned

Folder No. __________ Name: __________

Out:Map Nos. ______ To ______ Position ______ Time Out: ______

In Map Nos. ______ To ______ Signature ______ Time In: ______

Folder No. __________ Name: __________

Out: Map Nos. ______ To ______ Name: ______ Time Out: ______

Out: Map No. ______ To ______ Position ______ Time In: ______

Folder No. ______ To. ______ Name ______

Out: Map Nos. ______ ______ Position ______ Time Out: ______

In: Map Nos. ______ To. ______ Signature ______ Time In ______

Folder No: __________ Name: __________

Out Map Nos. ______ To. ______ Name: ______ Time Out: ______

In Map Nos. ______ To ______ Signature ______ Time In : ______

Folder No: __________ Name: __________

Out Map Nos. ______ TO. ______ Position ______ Time Out: ______

In: Map Nos. ______ To. ______ Signature ______ Time In: ______

EXHIBIT 3

CREW CHIEF'S CHECKLIST

Building Dimensions and Property Characteristics

Older No:

Property Type: ____________

Map No: ____________ To ____________

Date: ____________

Data Collector:

Crew Chief:

Data Assigned: ____________

Data Completed: ____________

1	Building Measurement		Building Characteristics		Parcel No	Building Measurement		Building Characteristics	
	OK	Change	OK	Change		OK	Change	OK	Change

EXHIBIT 4

AREA SUPERVISOR CHECKLIST

SUPERVISOR NAME: ______________________ DATE ______________

Folder No.	Map No. To	Map No.	Time In	Crew Chief: ______ Initials	Time Out	Initials

EXHIBIT 5

WEEKLY AREA SUPERVISOR'S REPORT

	Monday	Tuesday	Wednesday	Thursday	Friday
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					

EXHIBIT 6

MONTHLY AREA SUPERVISOR's REPORT

	1st Week	2nd Week	3rd Week	4th Week	5th Week
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					
Assigned: Folder No. No. Parcels Completed Parcels					

CITY OF BOSTON PROPERTY ...

PARCEL IDENTIFICATION NO:
MAP NO: BLK: LOT:
PROPERTY ADDRESS:
COORDINATE NO:

DATA PROCESSING NO:
WARD NO:
NEIGHBORHOOD:
YEAR BUILT:

BUILDING PERMITS		
DATE	NUMBER	% COMPLETE
		250
		251
		252

LOT AREA:
WIDTH: DEPTH:
EXCESS AREA:
ZONING: MLT. ZONING:

IMPROVEMENT DATA

CONDITION: 006 SUB-STAN. 007 FAIR 008 AVG. 009 GOOD 010 V. GOOD
EFF. AGE: 011

GRADE: 001 LOW 002 FAIR 003 AVG 004 GOOD 005 V GOOD
ARCH. DESN.: 014 RANCH 015 DUPLEX-TRIPLEX 016 TRI-DECK 017 ROW 018 A FRAME 019 PRE-ENG
OBSOLESCENCE: 012 FUNCT. 013 OC
EXT. WALLS: 023 STUCCO 024 SID/SHING 025 B.V. 026 COMM BR. 027 FACE BR 028 CON B
CONST. TYPE: 020 WD FRAME 021 MASONRY BR 022 MASONRY C.B
STORY HEIGHT: 029 1 STY 030 1½ STY 031 1¾ STY 032 2 STY 033 2½ STY 034 2¾ STY 035 3 STY 036 3½ STY 037 4 STY
SQUARE FEET
ROOF TYPE: 040 MANSARD 041 GAMB 042 FLAT 043 GABLE 044 HIP 045 OTHER
PERIMETER: 038 L.F.
TOTAL LIVING AREA: 039 SQ. FT.
FOUNDATION: 052 CONC 053 SLAB 054 CONC. SLB 055 STONE
ROOFING: 046 COMP SHING. 047 BUILT-UP 048 WOOD 049 SLATE 050 TILE 051 OTHER

INTERIOR FEATURES

PLUMBING: 062 BATH 063 LAV. 064 EXT FIX.
FLOOR CONST.: 056 STUD 057 SLAB
FLOOR FINISH: 058 SOFTWOOD 059 HARDWOOD 060 VINYL/LINO 061 CARPET
AIR COND.: 074
HEATING: 065 FORCED AIR 066 GRAVITY 067 RADIATOR 068 FLR FURNACE 069 RADIANT 070 BASE BD 071 WALL UNIT 072 HEAT PUMP 073 NONE
BASEMENT: 080 SQ. FT.
BASEMENT FINISH: 081 SQ. FT.
ENERGY SOURCE: 075 ELECT. 076 GAS 077 OIL 078 COAL 079 SOLAR
BUILT-IN'S: 082 STOVE 083 REFRIG. 084 DISHWASHER 085 DISPOSAL 086 HOOD/FAN 087 COMPACTOR 088 INTER-COM 089 VACUUM 090 SECURITY

GARAGES – PORCHES – MISC. IMPROVEMENTS

TYPE	091 ATTACH	092 DETACH	093 BUILT-IN
AREA			
GRADE			
COND.			

PORCHES

TYPE	094 OPEN	095 COVERED	096 ENCLOSED
AREA			
GRADE			
COND			

MISC. IMPROVEMENTS

TYPE	097 PAVING	098 FENCING	099
UNIT			
PRICE			

LAND COMPUTATIONS

USE CODE			100
UNIT PRICE			101
LOCATION ADJ.			102
SIZE ADJ.			103
PHYSICAL ADJ.			104
ADJ. UNIT PRICE			105
NUMBER UNITS			106
LAND VALUE			107

IMPROVEMENT SKETCH

315

BUILDING DIMENSIONS

LOCATIONAL INFLUENCES

STREET COND.: 108 BELOW STND. 109 STND. 110 ABV STND
SIDEWALKS: 111 BELOW STND 112 STND. 113 ABV STND
TRAFFIC: 114 NEIGHBHD 115 CONTRS 116 ARTER
NEIGHBORHOOD: 117 IMPR 118 STABLE 119 DECLINE

MISCELLANEOUS

120 WATERFRONT 121 PARK 122 VIEW 123 SECURITY
124 SHOPPING 125 NOISE 126 PARKING 127 MEDICAL
128 PUB. TRANS 129 CHURCH 130 HISTORICAL
131 132 133
134 135 136

EXCEPTIONS

137 OTHER PROP 138 UNFINISHED VALUE 139 INVALID SALE
140 EXEMPT PROP 141 RENT CONTROL 142 RESTRICTIONS
143 144 145
146 147 148

REMARKS

149
150
151
152
153
154

PROPERTY ADDRESS: NEIGHBORHOOD:

COORDINATE NO. YEAR BUILT:

STRUCTURAL ELEMENTS

MISCELLANEOUS DATA

COST ESTIMATE	COST APPROACH	VALUATION SUMMARY
	RCN. TOTAL	LAST ASSM'T. VALUE
	DEPRECIATION	SALE DATE / /
	FUNC. OBS.	SALE PRICE
	LOC. OBS.	COST VALUE
	RCLND. TOTAL	MRA VALUE
	MISC. IMP. TOT.	INCOME VALUE
	RCLND. + MISC. IMP.	CORRELATION
	LOC. FACTOR	
	ADJ. COST VALUE	
	LAND VALUE	
	MISC. COST	
	TOTAL COST VALUE	
SYSTEM VALUE $	APPR. VALUE $	FINAL VALUE $

LEGAL DESCRIPTION

RECORD OF OWNERSHIP

OWNER NAME:

MAILING ADDR:

DEED BK/PAGE: DATE: / / PRICE: TYPE:

FIRST PREVIOUS [illegible]

PREV. OWNER:

DEED BK/PAGE: DATE: / / PRICE: TYPE:

[illegible]

DEED BK/PAGE: DATE: / / PRICE: TYPE:

THIRD PREV. [illegible] SALE

DEED BK/PAGE: DATE / / PRICE: TYPE:

TAX EXEMPT CODE: DATE OF EXEMPTION: / /

LAND DATA

LOT SIZE: WIDTH: DEPTH: EXCESS LAND:

ZONING: MULTI-ZONE: LAND USE CODE:

PREVIOUS LAND VALUATIONS

	CODE	UNIT PRICE	NUMBER OF UNITS	LAND VALUE
1st PREVIOUS		.		
2nd PREVIOUS		.		
3rd PREVIOUS		.		

ASSESSMENTS

MO. YR.	LAND	BUILDING	TOTAL	ADJUST.
/				
/				
/				
/				
/				

APPR. NO.

CITY OF BOSTON PROPERTY RECORD CARD

RCEL IDENTIFICATION NO.: DATA PROCESSING NO.:

P NO.: BLK: LOT: WARD NO.:

OPERTY ADDRESS: NEIGHBORHOOD:

ORDINATE NO.: YEAR BUILT:

LEGAL DESCRIPTION

RECORD OF OWNERSHIP

IER NAME:

ILING ADDR.

ED BK/PAGE: DATE: PRICE: TYPE:

FIRST PREVIOUS SALE

EV. OWNER:

ED BK/PAGE: DATE: PRICE: TYPE:

SECOND PREVIOUS SALE

ED BK./PAGE: DATE: PRICE: TYPE:

THIRD PREVIOUS SALE

ED BK./PAGE: DATE: PRICE: TYPE:

LAND DATA

LOT SIZE: WIDTH: DEPTH: EXCESS LAND:

ZONING: MULTI-ZONE: LAND USE CODE:

PREVIOUS LAND VALUATIONS

	CODE	UNIT PRICE	NUMBER OF UNITS	LAND VALUE
1st PREVIOUS		.		
2nd PREVIOUS		.		
3rd PREVIOUS		.		

ASSESSMENTS

MO. YR.	LAND	BUILDINGS	TOTAL	ADJUST.
/				
/				
/				
/				

APPR NO.

AX EXEMPT CODE: DATE OF EXEMPTION: / /

LAND COMPUTATIONS

USE CODE	UNIT PRICE	LOCATION ADJ.	SIZE ADJ.	PHYSICAL ADJ.	ADJUSTED UNIT PRICES	NUMBER UNITS	LAND VALUE
	$	×	×	×	=	×	= $

IMPROVEMENT CLASSIFICATION

OCCUPANCY CODE QUALITY CLASS COST RANK TOTAL FLOOR AREA

NUMBER OF UNITS (Res'd. only) PERIMETER NUMBER OF STORIES STORY HEIGHT

EFFECTIVE AGE CONDITION EXTERIOR WALL HEAT COOLING

ELEVATORS SPRINKLERS BASEMENT

COST APPROACH

STRUCTURE

SQUARE FOOT ADJ.

LUMP SUM ADJ.

BASEMENT

PORCH

GARAGE

REPLACEMENT COST NEW

PHYSICAL DEPR.

FUNCTIONAL OBSOL.

LOCATIONAL OBSOL.

REPLACEMENT COST NEW LESS DEPR.

LAND VALUE

LAND IMPROVEMENTS

TOTAL COST VALUE

INCOME APPROACH

GROSS INCOME % $

VACANCY & CREDIT

EFFECTIVE GR. INC.

EXPENSES:

MAINTENANCE

UTILITIES

ADMINISTRATIVE

INSURANCE

TAXES (NON-R.E.)

TOTAL EXPENSE

NET INCOME

CAPITALIZATION RATE %

EFFECTIVE TAX %

DISCOUNT %

RECAPTURE %

CAPITALIZED VALUE

LAND

IMPROVEMENT

TOTAL PROPERTY

MARKET APPROACH

GROSS INCOME

GROSS INCOME MULTIPLIER

VALUE INDICATION

VALUATION SUMMARY

LAST ASSESSED VALUE $

SALE DATE / /

SALE PRICE $

COST VALUE $

MARKET VALUE $

INCOME VALUE $

CAPITULATION $

APPRAISER VALUE $

APPRAISER I.D.

FINAL VALUE $

ASSESSMENT RATES %

ASSESSED VALUE $

DATE / /

PARCEL IDENTIFICATION NO: | DATA PROCESSING NO:
MAP NO | BLK. | LOT: | WARD NO:
PROPERTY ADDRESS: | NEIGHBORHOOD:
COORDINATE NO: | YEAR BUILT:

DATE	NUMBER	DECL VALUE	PUR	% COMPLETE	LOT AREA.
				535	WIDTH
				536	EXCESS AREA
				537	ZONING — MLT ZONE

IMPROVEMENT DATA

BASE COST FACTORS

OCCUPANCY CODE 001 | QUALITY CLASS 002 | CONC. & STEEL A | REIN.-CONC. B | MASONRY C | WD. STEEL FR. D
COST RANK 003 | 1-2-3-4 | TOTAL FLOOR AREA 004 | NO. RES. UNITS 005
PERIMETER 006 | NO. STORIES 007 | STORY HGT. 008 | EFF. AGE 009 | YR. CONST. 010
CONDITION 011 | SUB-STANDARD 1 | FAIR 2 | AVERAGE 3 | GOOD 4 | VERY GOOD 5
EXTERIOR WALLS | MASONRY 012 | CURTAIN 013 | WOOD OR STEEL FRAME 014
MASONRY TYPES | BRICK ON BLK. 015 | CONC. BLK. 016 | REIN-CONC. 017 | TILT-UP CONC. 018 | SOLID BR. 019 | STONE 020
CURTAIN TYPES | CONC. 021 | CONC. & GLASS 022 | METAL & GLASS 023 | STEEL & GLASS 024 | BRNZ. & GLASS 025 | BLK. BR. 026
WOOD & STEEL FRAME | ALUM. SIDING 027 | SANDWICH PANELS 028 | CORR. STEEL 029 | ABS. SIDING 030 | SHAKES 031
HEATING COOLING (MULTIPLE TYPE) | STEAM WITH BOILER 032 | STEAM WITHOUT BOILER 033 | AIRCOND., HOT & CHILLED WATER 034
AIRCOND., WARM & COOLED AIR 035 | PACKAGE HEATING & COOLING 036 | HEAT PUMP 037 | EVAPORATIVE COOL 038
REFRIGERATED COOLING 039 | VENTILATION 040 | WALL FURNACE 041 | ELECTRIC PANEL OR RATE BD. 042
ELECTRIC WALL HEATERS 043 | FORCED AIR 044 | FLOOR FURNACE 045 | GAS STEAM RADIATOR 046
GRAVITY FURNACE 047 | HEATERS VENTED 048 | HOT WATER 049 | SPACE HEAT GAS 050 | STEAM 051
BASEMENT 052 (SQ.FT.) | BASEMENT FINISHED 053 (SQ.FT.)

RESIDENTIAL BUILT-INS

NUMBER OF KITCHENS 054 | DISHWASHER 055 | EXHAUST FAN 056 | GARBAGE DISPOSAL 057
GAS INCINERATOR 058 | FOOD CENTER 059 | OVEN 060 | OVEN (MICROWAVE) 061 | RADIO-INTERCOM 062
RANGE & OVEN COMBO. 063 | RANGE TOP 064 | REFRIGERATOR 065 | TRASH COMPACTOR 066 | VACUUM SYS. 067
068 | 069 | 070 | 071 | 072
FIREPLACES | ONE STY. SINGLE 073 | ONE STY. DOUBLE 074 | TWO STY. SINGLE 075 | TWO STY. DOUBLE 076
RESID. GARAGES (SQ.FT.) | DETACHED 077 | ATTACHED 078 | BUILT-IN 079 | BASEMENT GARAGE 080
PORCHES (SQ.FT.) | OPEN SLAB 081 | COV. SLAB 082 | RAISED W STEPS, OPEN 083 | RAISED W STEPS, COV. 084

COMMERCIAL & INSTITUTIONAL BUILT-IN'S

STANDARD EQUIPMENT | BANKS 085 | JAIL 086 | HOSPITAL 087 | LABORATORIES 088
BANK VAULTS (SQ.FT.) MONEY 089 | RECORDS 090 | STAGES W/FIXTURES (SQ.FT.) 091
ELEVATORS (NO. SHFS. & STOPS SHAF) FULLY AUTO 092 | / | / | MANUAL 093 | / | / | FREIGHT AUTO. 094 | MANU. 095

LAND DATA

USE CODE 096 | WIDTH 097 | DEPTH 098 | EXCESS AREA 099 | ZONING 100 | MULTI-ZONE 101
TOPOGRAPHY: LOW/WET 102 | LOW/FAST 103 | LEVEL 104 | HIGH 105 | SLOPE 106
SHAPE: SQUARE 107 | RECTANGULAR 108 | IRREGULAR 109 | STREET EXPOSURE: INSIDE LOT 110 | CORNER 111
STREET ACCESS: ONE STREET 112 | TWO STREETS 113 | THREE PLUS 114 | TYPE: RESID. 115 | ARTERIAL 116 | INTER. 117
UTILITIES: WATER 118 | SEWER 119 | ELECTRICITY 120 | GAS 121 | RAIL 122
TRANSPORTATION: NONE 123 | BUS 124 | RAPID TRANSIT 125 | AIR 126 | WATER 127
INSPECTION DATE 128 | APPRAISERS I.D. 129 | REMARKS 130

CHAPTER FIVE - SYSTEM TESTING

1. Introduction

Testing is a necessary part of the orderly and systematic implementation of a mass appraisal system. Through the testing process, the entire equalization system may be simulated. A testing program provides the opportunity to put a system into operation, in miniature, without the time and expense that would be involved in total implementation. If there are problems in the design of the overall system, they should become evident during the testing phase.

There will be two full tests of the Boston Equalization System. The first will be called the Initial Random Testing Program. This will be pre-data collection testing to see if the system will perform as designed. The second phase, called the Final Testing Program, will commence after data collection but before the system is used to produce a tax roll of assessed values. This second phase will serve to further insure that the system, after data collection, is operating in the manner intended.

2. Initial Random Testing Program

A. Overview

The initial testing program will commence prior to the actual data collection phase but cannot occur before completion of the basic automated systems design and development phase. This section will describe the actions necessary to maximize the effectiveness of the testing program. The major sections discussed below are:

-Assignment of Personnel

-Data Collection

B. Assignment of Personnel

The testing phase will serve as an educational training mechanism for the personnel who will be in supervisory positions during the actual Data Collection Phase. The personnel assigned to this phase should be the four (4) Area Supervisors and the twelve (12) Crew Chiefs who will be in charge of the actual Data Collection program when it commences.

The objective of the initial testing program, as it relates to data collection, is to simulate the actions of the field teams who will eventually collect the data. The make-up of these teams (discussed in Chapter III), for actual field operations was described as follows:

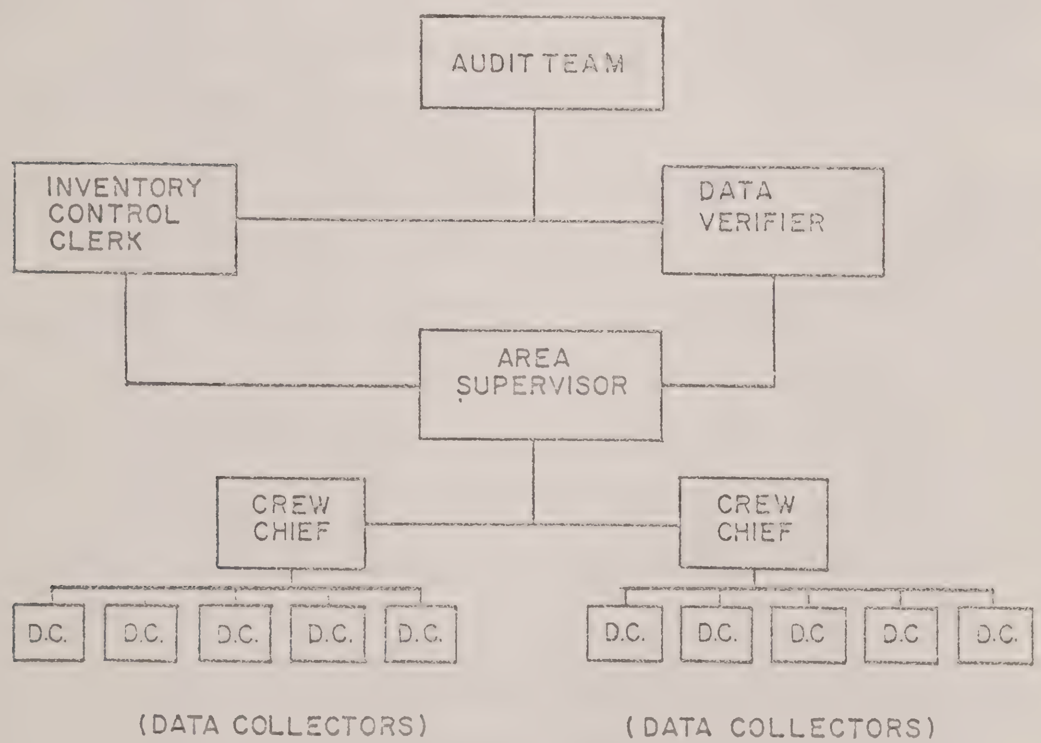
Position	Total Personnel
Area Supervisor	4
Crew Chief	12
Data Collectors	60

It may be noted that there are a total of sixteen (16) Area Supervisors and Crew Chiefs combined. They will share duties and work at those levels of operations at which they will eventually perform.

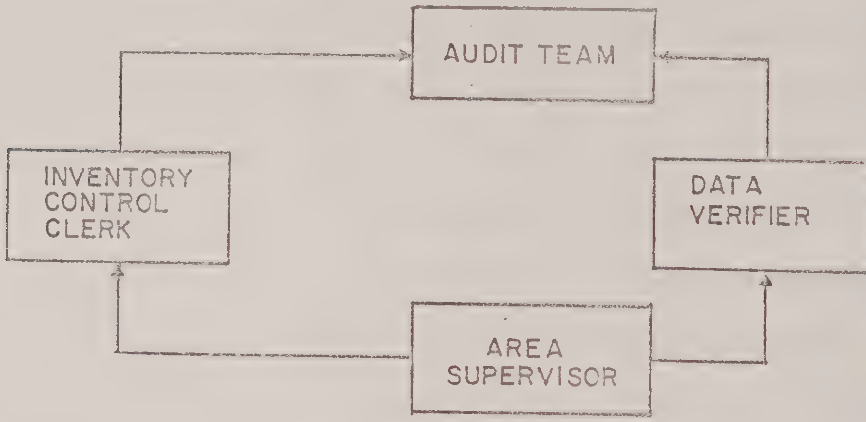
There are three other positions in the data collection phase which will be involved in the testing program. These are the Inventory Control Clerk, the Data Verifier, and the personnel assigned to the autonomous Audit Team. The names of the positions to be filled during testing and the titles of those filling the positions are as follows:

Name of Position	Person Filling Position During Testing	No. of Persons
Audit Team	Area Supervisor	1
Inventory Control	Area Supervisor	1
Data Verifier	Area Supervisor	1
Area Supervisor	Area Supervisor	1
Crew Chief	Crew Chief	2
Data Collector	Crew Chief	10

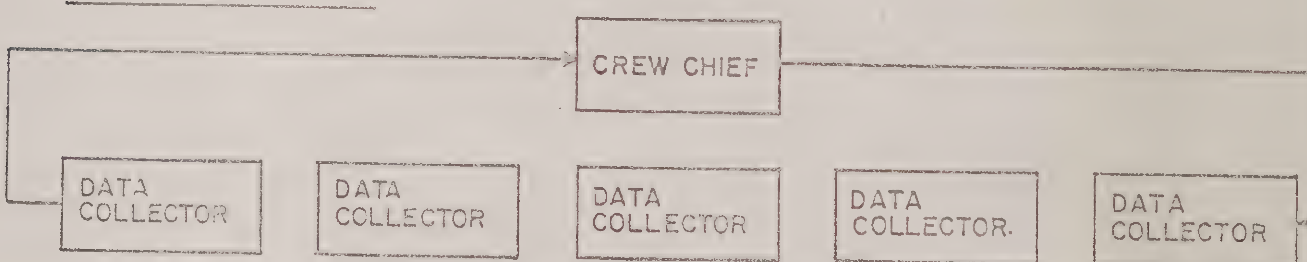
These assignments may be studied from an organizational point of view as follows:



These personnel will rotate in their jobs so that they will have performed all duties pertinent to their eventual responsibilities. There will be two general areas of job rotation for the Area Supervisors and Crew Chiefs during the testing phase. This rotation will be accomplished as indicated below:



CREW CHIEF (2 teams)



Through the process of sharing the duties of both supervisors and subordinate personnel, the area supervisors and crew chiefs will have a much better understanding of the functions (and problems) associated with each position related to their own.

1. Specific Actions Required in Assignment of Personnel

a. Hiring of Personnel

The four Area Supervisors and twelve Crew Chiefs will have to be hired prior to testing. This will involve advertising for the positions and interviewing personnel. It should again be noted that the personnel hired to fill these positions will become the supervisory personnel in charge of the entire data collection phase of the equalization program. It is, therefore, important that the selection process result in hiring qualified and competent personnel.

b. Training of Personnel

Once the supervisory personnel are hired, they must undergo extensive training in appraisal techniques and data collection procedures. This should include classroom training in both of these areas. It is recommended that a training program be developed which will encompass both appraising and data collection, utilizing text books, lectures and slide presentations. The training of personnel should be completed within two to three weeks and culminate with the collection of sample data by all participants.

C. Timing of Initial Testing Phase

The initial testing phase will require at least three months. This will allow for data collection on 3,400 parcels of real estate. The testing phase of three months is required to allow for collection of an adequate and representative sample of properties to simulate a test of the entire system. During this time, simultaneous evaluations will be occurring regarding the data collection forms and procedures; projections of "parcels per person"; and the valuation models.

D. Selection of Property-Type Groups & Sample Size by Group

Since any sample above 2,500 parcels will be sufficient for the initial test of the equalization system, a main consideration in selection of the sample size (as long as it is above 2500) will be the goal of thorough training of all personnel as described above.

It is estimated that 6,000 standard parcels are required to meet this goal. For the purposes of testing, these standard parcels must be stratified into four groups which accurately reflect the distribution of property in the City of Boston. These groups are Residential, Commercial, Industrial and Land and they should include exempt as well as taxable properties. Exempt properties are different from other parcels of real estate only by their status concerning taxability. The four groupings with respective parcel counts are as follows:

General Property Type	Property Use Code	1978 Number* of Parcels	Percent of Total
Residential	R1,R2,R3	74,257	70%
Commercial	R4,Rc,Co,C,D	17,741	17%
Industrial	I	1,070	1%
Land	L	12,596	12%
		105,664	100%

*Exempt property has been proportioned into the four groupings.

Where: R1= One Family Residential

R2= Two Family Residential

R3= Three Family Residential

R4= Four or more units, Residential

RC= Mixed Residential, Commercial

CO= Condominiums

C= Commercial

D= Dormitory

I= Industrial

L= Land

The number of parcels to be collected within each of the four groupings is shown below after converting "standard parcels" to "actual parcels", in accordance with the methodology developed in this Manual.

Property Type (General)	Standard Parcels	Ration of Std. Parcels to Actual Parcels	Number of Actual Parcels	Percent of Total
Residential	2,394	1:1	2,394	70%
Commercial	2,852	5:1	570	17%
Industrial	347	10:1	35	1%
Land	407	1:1	407	12%
	6,000		3,406	100%

E. Data Collection

1. Overview

The data collection portion of the initial testing phase is the most time consuming part of the testing program. Three months are alloted for completing the data collection phase.

This phase consists of two distinct parts:

1. Field Operations
2. Evaluation of Field Operations

Though distinct in function, both field operations and evaluation will be occurring simultaneously.

1. <u>Field Operations Phase of Data Collection</u>

The field operations phase of data collection involves the measuring of each property in the sample and listing of all data base items on property record cards (PRC) for each property.

There are several actions which must precede field operations. These are:

1. The Design and printing of data collection and inventory control forms.
2. Delineation of neighborhoods must be accomplished.
3. Unique parcel identification numbers must be assigned to every parcel of property in the City.
4. Hiring of Personnel.
5. Training of Personnel.
6. Obtaining Equipment for Personnel.

Once the above prerequisites are met, the field operations may proceed. There two specific actions which must take place as this occurs:

a. Random selection of Neighborhoods, and
b. Collection of Data

a. <u>Random Selection of Neighborhoods</u>

In order to be confident that the data collection phase of the testing program occurs without "bias", neighborhoods, and properties within neighborhoods, should be chosen randomly. This may be accomplished by using a Random Numbers Table. These numbers identify specific neighborhoods for which data will be collected. The same process may be followed for selecting properties within neighborhoods. The eventual confidence placed in the accuracy of the data collection and valuation systems will be based on the results of the testing phase. It is therefore paramount that everything possible be done in the testing phase to minimize the amount of bias which may occur.

b. Collection of Data

The collection of data during testing encompasses the same distinct steps which are to be followed during final data collection. (See Chapter Three)

1. Area Supervisors are assigned specific areas for field collection.
2. Area Supervisors pick up, and sign for the appropriate property record cards, (PRC), from the Inventory Control Clerk.
3. Area Supervisors assign specific properties to their Crew Chiefs and sign over the P.R.C.'s to the Crew Chief.
4. Crew Chiefs assign specific properties to each Data Collector and sign out P.R.C.'s to the Data Collectors.
5. Data Collectors return completed PRC's to the Crew Chiefs.

6. Crew Chief checks and verifies the P.R.C. for completion and accuracy.

7. Crew Chief returns P.R.C.'s to the Area Supervisor.

8. Area Supervisor makes spot-checks for completion of records.

9. Area Supervisors return completed P.R.C.'s to the Inventory Control Clerks.

10. Inventory Control Clerk "logs-in" records and turns them over to Data Verifier.

11. Data Verifier checks every P.R.C. to insure all appropriate parts have been filled out.

12. The Analytic Unit makes random selections of properties for the Audit Control Team to "field verify".

13. Audit Team checks out P.R.C.'s from Inventory Control Clerk.

14. Audit Team field visits, measures, lists data and returns P.R.C.'s to Inventory Control Clerk.

15. Audit Team makes out audit report.

3. Field Operations-Evaluation

The Field data collection process must be evaluated. There are four basic areas for evaluation:

a. Check Adequacy of Collection Forms

All data collection forms should be evaluated to see if they performed as they were designed. Personnel involved in the test program should be encouraged to assist in any needed redesign of existing forms or the design of new forms. Each item on the PRC should be reviewed with the data collectors to see if there are unnecessary items or if the listing process would be facilitated with items rearranged on the card. This initial testing phase is the last opportunity for instituting any change in the format or content of collection forms without delays and additional costs. The forms which should be evaluated are:

1. Property Record Card-Residential.
2. Property Record Card-Commercial/Industrial.
3. Inventory Control Forms.
4. Crew Chief's Checklist.
5. Area Supervisor's Checklist.
6. Monthly Area Supervisor's Report.
7. Weekly Area Supervisor's Report.

b. <u>Check Adequacy of Collection Forms</u>

This step refers to the physical deployment of personnel. It is anticipated that the actual listing procedures will not be as subject to change as will the process of physically moving personnel from property to property. Time may be saved by the manner in which the crew chiefs assign properties to Data Collectors. The optimum process will hopefully be found during the testing phase. The optimum procedure will provide for each data collector to be continually moving from one property to another, with a minimum of time spent in an automobile driving to a new property.

c. Check Adequacy of Projected Standard Parcels Per Person

The number of standard parcels has been estimated based on the consultant's prior experience in data collection programs. The initial estimate, as presented earlier, is as follows for the four general property types:

PROPERTY TYPE	RATIO
Residential	1:1
Commercial	5:1
Industrial	10:1
Land	1:1

In this ratio "1" is the time required to list and measure a single residential parcel. It has also been estimated that a field data collector can measure and list 10 standard parcels per day (See Chapter 6). This would mean that, on average, one should be able to list two commercial properties per day, or one industrial property per day. These initial estimates will be tested and proven correct or incorrect during the testing phase. This portion of the evaluation will serve to insure that the number of standard parcels per day per person is based on actual data collected in the City of Boston.

As will be illustrated in the next section, this estimate is important in the overall planning since it will determine whether or not additional time and/or personnel will be needed during the complete data collection phase.

d. Check Number of Projected Personnel Required

This part of the evaluation will utilize the standard parcel count in order to more accurately estimate the number of personnel required. The formula used in this calculation, presented earlier, is as follows:

P X SPL X SWD X (CDP/365) = SP

FORMULA INGREDIENTS		INITIAL ESTIMATES
P=	Personnel Required	60
SPL=	Standard Production Level	10
SWD=	Standard Working Days	203
CDP=	Calendar Days in Phase	730
SP=	Standard Parcels	243,600

The ratios presented earlier for the time required for data collection on property other than residential may be in error. If, for example, the testing phase found that it took longer than estimated to collect data on commercial and industrial properties (and therefore, exempt properties since they are generally of these types), the formula could be adjusted. It would then become evident that an additional number of working days, or additional personnel, would be required.

Assume, for example, that the estimates for the ratios were found to be more accurately represented as shown below. The additional number of days or personnel as shown would be:

Property Type	Orig. Est. of Parcels Std. to actual Parcels	1978 No. Parcels	Revised Ratio Std. Parcels	Revised No. Std. Parcels
Residential	1	67,227	1	67,227
Commercial	5	16,061	6	96,366
Industrial	10	969	12	11,628
Land	1	11,404	1	11,404
Exempt	7.5	10,003	9	90,027
		105,664		276,652

Revised Number of Personnel

P x SPL x SWD X (CDP/365)= SP

P X 10 X 203 X 2 = 276,652

4060P= 276,652

P= 68

Original Estimates = 60 Personnel

Revised Estimates = 68 Personnel

Additional Required Personnel= 8

Revised Number of Days in Phase:

P X SPL X SWD X (CDP/365) = SP

60 X 10 X 203 X (CDP/365) = 276,652

CDP = 829

Original Estimate of CDP = 730 Days

Revised Estimate of CDP = 829 Days

Additional CDP = 99 Days

If the above revised standard parcel ratios were found to be accurate as a result of the testing phase then the original estimate of the time needed for data collection would have to be altered <u>or</u> additional personnel would have to be hired. In the example above, as a result of proper planning and testing, the management team would know <u>prior</u> to initiating the complete program that either an additional 8 data collectors or an additional 99 work days would be required. The only other available option would be to increase the daily parcels per person to be listed by the data collectors. This could be estimated as follows:

$$P \times SPL \times SWD \times (CDP/365) = 276{,}652$$

$$60 \times SPL \times 203 \times 2 = 276{,}652$$

$$SPL = 11.36 \text{ Parcels}$$

In other words, if the hypothetically presented revised standard parcels were established as a result of the testing phase, the same number of personnel (60) could complete the data collection phase in the projected time frame (703 days) by increasing their daily parcels listed from 10 to 11.36.

F. <u>Program Testing: Valuation Models</u>

The testing of the valuation models involves two phases:

1. Testing and Evaluation of Computer Programs
2. Evaluation and Analysis of Valuation Models.

1. <u>Testing and Evaluation of Computer Programs</u>

This phase of testing will involve running all of the data collected through the appropriate approaches to value to insure that computer programs are operating properly. Valuations should be checked by calculating random property values manually and checking these values against those generated by computer. Errors will require the de-bugging of programs and analysis of the system design.

2. Evaluation and Analysis of Valuation Models

The Performance Analysis Section of this report describes in detail a series of statistical reports which are designed to estimate the accuracy of the overall system. These reports are listed below. They should be generated against data from the initial data collection testing period.

1. Ratio Calculation
2. Ratio Analysis for City of Boston-Aggregate Report
3. Ratio Analysis by Location
4. Ratio Analysis by Property Type
5. Ratio Analysis by Grade for Residential and Commercial.

The actions required as a result of these reports are explained in Chapter I. This performance analysis portion of the testing phase will serve to evaluate the entire system in miniature which is the ultimate purpose of the testing program.

3. Final Testing

Final testing refers to an evaluation program which will be instituted after the data collection has been completed, but before the property tax roll has been generated and made official. The steps will be the same as presented earlier since all field operations have been completed.

Random samples of properties will be chosen for manual calculation of values and will be double checked against computer generated values. Properties and neighborhoods may be revisited if inconsistencies cannot be reconciled in the system. The purpose of this final testing is to insure a working, equitable system prior to final tax roll preparation.

CHAPTER SIX -

ADMINISTRATION IN THE DEVELOPMENT AND OPERATION OF THE EQUALIZATION SYSTEM

Introduction

The report, up to this point, has been a technical discussion of the design and development of the Boston Equalization System. The purpose of this chapter will be to depict the Equalization System in an orderly flow, identify work modules, and address administrative considerations required in the operation of the System.

The Boston Equalization System is a sophisticated approach to equalization and continued re-assessment, designed to achieve and maintain equalization of real estate values for the purpose of taxation. The System is designed around accepted appraisal techniques, and utilizes computer processing to minimize the mass data processing required in equalization, and the maintenance of an assessing system containing over 100,000 parcels of real estate. The Administrator will have to manage an organization composed of diverse employee types, ranging from data entry clerks, through professional appraisers and to highly technical statisticians and systems engineers. The program will also involve utilizing an equally wide range of equipment from the hand-held calculator to an IBM Computer 370 Model. The Administrator can not be completely familiar with every routine in the System. However, the Administrator must be acquainted with the overall flow of work programs and administrative decision points which are necessary to ensure the highest quality of equalized values.

Therefore, the purpose for this section will be to discuss from an Administrator's point of view, system flow, required work tasks, administrative decisions, organizational structure for personnel, and a phase timetable for work assignment and accomplishment.

The Office of Property Equalization is currently developing the Equalization System. When development and implementation are completed, and a valuation roll can be produced for all properties in the City of Boston, the System should be interfaced with existing assessing function for continued operation and maintenance. This process of development and implementation, and operation and maintenance is discussed in this chapter in the following manner:

Phase #1 Development of the Equalization System

Phase #2 System Operation and Maintenance

1. Phase #1: Development of the Equalization System

The first step in the development of an equalization system is planning and organization. The Administrator must plan for the needs of the equalization program and organize an orderly and timely program of implementation.

The Development Phase of the Boston Equalization System contains seven major areas of concern. They are:

A. System Design

B. Program Design (Electronic Data Processing)

C. Data Sampling Program

D. System Testing

E. Data Collection

F. System Up-Date

G. General Organization

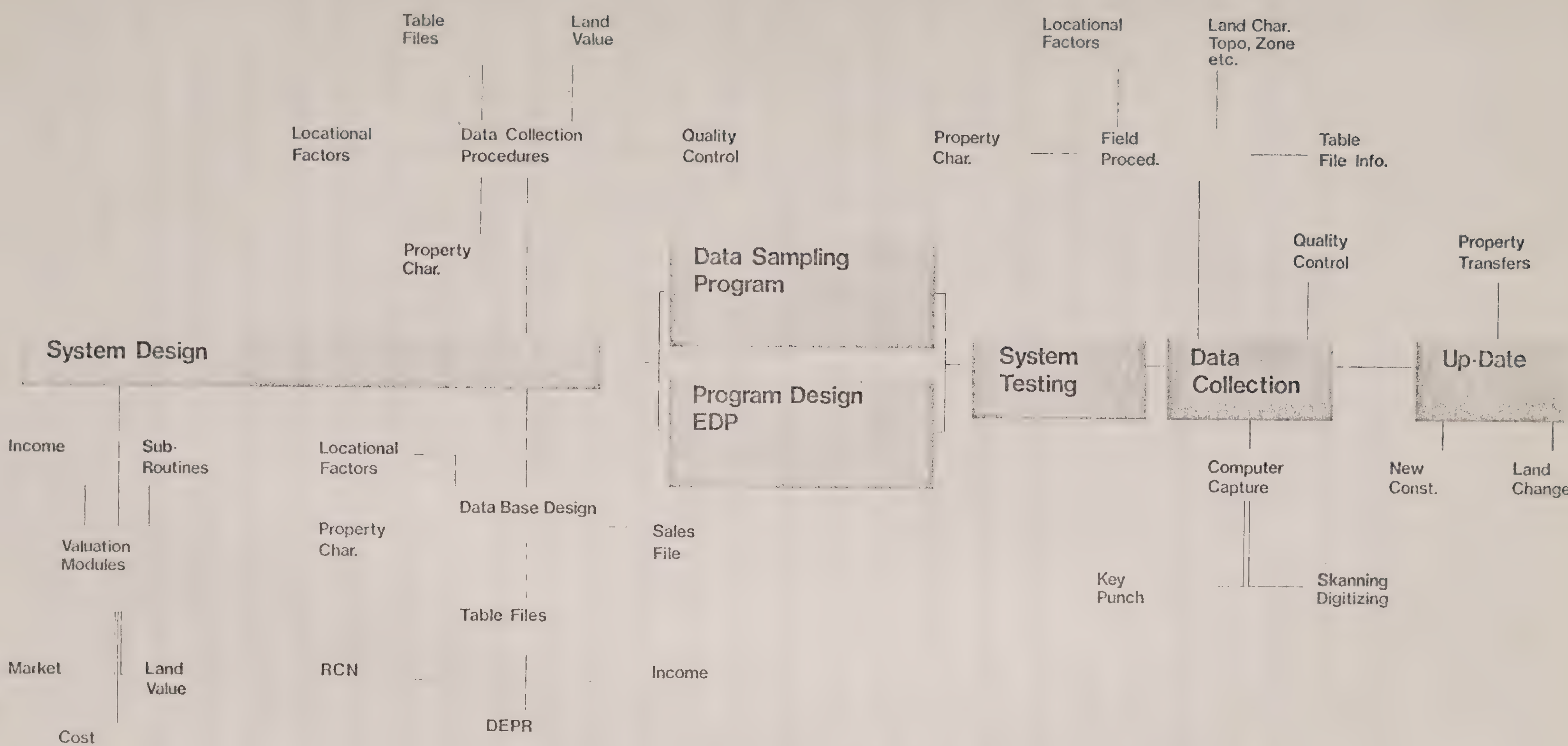
Each component has been discussed in detail earlier in this report. This section will provide a brief recapitulation of each component, define the components' relationship with each other within the total program, and outline the administrative requirements of each. A graphic illustration of proposed development plan follows this page, and a written description of each major element follows that.

A. <u>System Design</u>

In the proper design of an equalization system, the Administrator must anticipate the working need of the valuation of real estate in a mass appraisal. Although established appraisal methods will be utilized and the steps for valuation in these methods have been clearly defined, the Administrator must determine the appropriate valuation techniques required on the various property types. He then must structure a system that will apply these chosen procedures in the same manner to each selected property type. The Administrator must also determine the method of application of various system procedures. Some procedures easily lend themselves to computer applications while others will require manual applications. Every step must be identified and the tasks to develop each must be clearly defined.

In the basic system design, one must be concerned with the following:

Development of Equalization System



1. Valuation Modules:

Valuation Modules include the Cost, Market and Income Approaches to value, sub-routines for analyzing market indicators with mass data, statistical application and land valuation techniques. From the Administrator's point of view, consideration must be given to which valuation approaches are applicable to the various property types, what work requirements are necessary to process the valuation modules and the organization in which these tasks will be accomplished. Each valuation module will be considered separately:

The Cost Approach produces the value of a subject property based on the principle of substitution. This approach assumes that the property being appraised is replaceable in today's market. In individual appraisals, this approach is most applicable to new properties or properties constructed for one special purpose. In mass appraisal, the Cost Approach is considered appropriate in valuing all properties because the value produced is based on the cost of individual property characteristics. Since the system produces values for comparable property types in similar neighborhoods, a high degree of equality is obtained. In addition, results of the Cost Approach will be utilized in other approaches to value.

The Administrator's primary concern is that the manuals which are used to estimate Replacement Cost New are reliable and updated to reflect increasing or decreasing building costs. Sub-routines within the system are used to monitor quality control, cost tables, depreciation tables and neighborhood factors. These adjust Replacement Cost New to reflect changing conditions and market reactions at the neighborhood level. Differences within the individual property types due to quality of construction and physical condition are also noted.

Administrative considerations for the Cost Approach are:

a. Identification of properties in the City of Boston which will be valued by the Cost Approach.

b. Creation of a Cost Manual.

c. Establishment of an Analytic Unit for maintaining the table files.

Land Value is an intricate part of the Cost Approach. However, due to the inherent characteristics of land value related to improvement value, it has been recommended that land value be a product of a Land Valuation Unit. This Unit is described in detail earlier in the Report.

Adminsitrative considerations of Land Valuation are:

a. Establish Land Valuation Unit

b. Delineation of Neighborhoods

c. Development of Land Valuation Charts.

The Market Approach is a method of examining arms length sales for the purpose of abstrating indications of value that may be applied in the valuation of all properties.

One technique used to apply the Market Approach a mass application is Multiple Regression Analysis (MRA). MRA is totally dependent upon the availability of sales data and its use is most effective in valuing single residential properties. Multiple Regression Analysis, however, is highly techinical and difficult for the typical taxpayer to understand. In addition to being an application of the Market Approach, it is a useful tool in a mass equalization system for testing valuation produced by the other approaches. With this in mind, the administrator is concerned primarily with when Multiple Regression Analysis should be applied and less importantly with its technical detail. Multiple Regression Analysis is described in detail earlier in this Report.

Administrative considerations of the Market Approach are:

1. Determination of the sufficiency of sales by property class and type in the City of Boston.
2. Identification of which properties will be valued by Market Approach and which techniques will be utilized.
3. Delineation of Neighborhoods.

The Income Approach is a process for estimating property value based upon the present worth of the property's future income-earning capabilities. The approach has been fully described earlier in the Report. The fact that the approach requires the input of specific, accurate income and expense information is of great importance and concern to the Administrator. Determination of the Capitalization Rate is a critical factor in the utilizing the Income Approach. Consequently, analytic personnel must be adequately trained in income valuation techniques.

Administrative considerations of the Income Approach are:

1. Identification of properties in the City of Boston to be valued by the approach.
2. Establishing procedures for maintaining income and expense information from property owners.
3. Calculation of Capitalization Rates by the Analysis Unit.

2. Data Base Design

It is imperative that the Data Base be adequate for processing the valuation modules. Because of this, Data Base Design is an important phase in development. Data base requirements relate directly to the valuation modules, and can be generally categorized as:

1. Locational Factors.
2. Property Characteristics.
3. Table Files.
4. The Sales History File.

Data Base factors are described in detail earlier in this Report but are listed briefly below:

Locational Factors are used to determine why properties equal in cost and condition vary in price due to location and environment. Locational factors are also an integral part of Multiple Regression Analysis, as location plays a key role in determining the sales price of a property. Therefore, locational factors should reflect the social, economic, political and physical conditions that would motivate a buyer or seller in market transactions.

Property Characteristics describe the physical property under appraisal. The property characteristics reviewed should be related to cost table requirements, and will also be required in Multiple Regression Analysis.

Table Files must be created for storing value-influencing information. Table files must be constantly monitored and updated. Examples of table files are Replacement Cost New tables, Depreciation tables and Income and Expense Factor tables.

Sales History File is another key element in Data Base Design. All value influencing characteristics, sub-routines, value estimates, and sales ratio studies must be compared to known market values in order to determine their accuracy and usefulness in predicting property values for all properties within the system. Therefore, it is imperative that a Sales History File be created for the purpose of storing all historical sales by time, location and physical characteristics. This file is constantly referenced for maintenance and performance analysis throughout the automated equalization system.

Administrative considerations in Data Base Design are:

1. All information needed for the Valuation Models must be properly identified.
2. Development of an overall system flow, in which the computer will access the Data Base and apply information stored to valuation modules in the recommended manner.

3. Data Collection Procedures

After the establishment of a Data Base as required by the mass equalization system, it is the Administrator's responsibility to establish a Data Collection Program. As a precondition of the establishment of a Data Collection Program all procedures must be planned and clearly delineated. Data Collection procedures have been outlined and discussed in detail in this Report. General areas of management concern are:

1. Property Characteristics.
2. Locational Factors.
3. Table Files.
4. Land Value.
5. Quality Control.

Property Characteristics recordation represents the largest, and most lengthy component of the development of the Equalization System. Each individual parcel of real estate in the City of Boston must be visited for the purpose of measuring, listing and describing the improvements thereon. It will be necessary for the Administrator to set up guidelines, training sessions, and procedures for inventory control to ensure that this program runs efficiently. Property characteristics with regard to land, zoning, and in some cases building descriptions, may be recorded in other City Departments. These must be accessed for addition to the Data Base.

Locational Factors refer to the value-influencing factors existing outside the boundaries of each individual property, such as overall neighborhood conditions. These tend to be subjective and must be defined in such a manner that regression programs will accept the presence of a defined factor and not the opinion of the field person. It is suggested that the definition of Locational Factors be an additional function of the Analytical Unit.

Table Files contain information collected from many different sources. Cost Factor tables are developed from actual contractors' statements or are furnished by various cost services. Depreciation tables should be built in a manner that reflects typical depreciation for various classes of property. Income and Expense Table Files should come from the actual market. They must be examined carefully so that they reflect typical conditions under competent management. It is the Administrator's responsibility to see that table files are continuously monitored.

Land Valuation also requires a team approach with trained appraisers.

Quality Control is necessary in any program dealing with a number of people collecting a variety of information. It is the consultant's opinion that quality control be maintained by a Verification Section responsible for verifying field cards used in collection for omissions, inaccurate computations, etc. Also, it is recommended that an Audit Control Team be set up to randomly audit the ongoing operation. Different methods of auditing should be employed for the purpose of ensuring the highest quality product.

Administrative considerations in Data Collection Procedures are:

a. Definition of task in compatible work modules.

b. Estimation of personnel requirements and time frame for each task.

c. Establishment of procedural guidelines for each data collection phase.

d. Development of quality control technique.

e. Establishment of training programs.

B. <u>Program</u>

The mass equalization approach must value over 100,000 parcels of real estate. In order to accomplish this work, the administrator must utilize automated equipment. Whenever a procedure can be delineated as a step-by-step routine and this same procedure can be applied to a large number of parcels to be appraised, electronic data processing is considered necessary. Consequently, the primary concern of the Administrator in this component is to identify the cost procedures to be computerized and set up and manage the organizational structure for accomplishing this purpose. It is recommended that this phase of development be implemented in-house under the authority of an EDP Director with consultant assistance.

1. Identification of those parts of the overall system that are suitable for electronic data processing application.
2. Design the automated system.
3. Identify necessary programs.
4. Write identified programs.

After the desired computer programs have been written it is important to test these programs prior to implementation. In order to properly test program design, sample data must be available to run through the computer. These data serve to test the program procedures as well as the logic of systems design (valuation modules, data base design, etc.). Therefore, it is recommended that the administrator collect data for different property types within each neighborhood for use in the testing phase. The data sampling program would represent in smaller scale the complete data collection program and consequently serve as a training program for supervisors to be used in the upcoming complete field collection program. It is recommended that samples for testing be taken from all property types that will be processed by the computer.

C. Data Sampling Program

A Data Sampling Program is necessary for testing purposes. This sampling will also mark the first major aspect of the Data Collection Phase of the Boston Equalization Project.

One purpose of this sampling program is to test and evaluate the recommended Data Collection Procedures. A second purpose of this program is to obtain sample data on all property types to be used in developing and implementing Electronic Data Processing (EDP) programs. This program cannot start until the completion of Program Design. It should run concurrently with EDP programming because the results are necessary for system testing.

This program and system testing are discussed in detail in Chapter V of this Report.

Administrative considerations in Data Sampling are:

1. Identification of sample areas by property type and number.
2. Assignment of personnel.
3. Training of personnel and writing of training manuals.

4. Establishing random selection process to ensure samples are representative.

5. Reviewing Data Collection Procedures.

6. Revision of collection procedures prior to Citywide Data Collection.

D. Systems Testing

Valuation Modules as well as electronic data processing programs should be tested and de-bugged prior to actual operation. It is simpler to de-bug a system using a small sample than it is to de-bug that system after all the data have been entered and processed.

System testing is the running of all programs as designed with actual market data and making alterations where necessary. Administration considerations of system testing are:

1. Processing data through the computer system.

2. Evaluation of computer programs.

3. Evaluation of valuation models.

E. Data Collection

Data Collection is that phase in which all data elements required in Data Base Design are recorded by field and in-house procedures and stored for computer processing. The Data Collection phase involves the organization previously discussed under Data Collection Procedures. Data Collection is the most time-consuming phase in the equalization project. Details are discussed in Chapter III, Data Collection.

Administration considerations of Data Collection are:

1. Number of personnel to be involved and organization of personnel with regard to job description, accountability and reportability.
2. Accommodations for personnel with regard to office space and equipment needs.
3. Proper planning and management necessary to implement this phase accurately and on schedule.

F. System Up-Date

It is anticipated that development of the equalization system will occur over a three year period of time. It is inevitable that many changes will occur to properties in the way of new construction, property transfers and land changes over this time frame. In other words, the data base will be somewhat outdated before it can be used in totality. Therefore, the Administrator must set up procedures to record all property changes during the data collection phase and update the data base immediately prior to producing equalized values.

Administrative considerations of System Update are:

1. Recording and storing in a transaction file all ownership changes.
2. Recording and storing in a transaction file all parcel changes.
3. Recording and storing in a transaction file all improvement changes.

4. Recording and storing in a transaction file all legal changes.

5. Inputting changes into the system at the appropriate time.

G. General Organization

Heretofore, system flow and individual work modules have been identified for the Administrator. At this point, a general framework will be outlined to assist the Administrator in establishing the organization necessary to complete these tasks.

In keeping with city policy, the equalization effort is the responsibility of the Office of Property Equalization which is directly accountable to the Mayor of the City of Boston. As in any organizational structure, the upper levels of the organization chart represent policy makers and administrators, with a decreasing management responsibility and increasing technical responsibility toward the lower levels of the organization chart.

Development of an organization delineated in an organizational chart is a direct responsibility of the Administrator. Such a chart must be developed and must clearly depict a chain of command. The recommended organization charts on the following pages are advisory only and are intended as guides.

1. Recommended Organizational Structure

The Director of Equalization is appointed by the Mayor of the City of Boston. Serving in a direct advisory roll in the equalization process are the Deputy Mayor for Fiscal Affairs and the Commissioner of Assessing. The following is the consultant's recommended structure.

The Director of Equalization oversees the entire equalization effort. Accountable directly to the Director should be a Legal Service Officer and a Public Information Officer. In addition, it is recommended that committees be established for the purpose of advising the Director in professional, technical, and procedural areas. These committees should be advisory in nature.

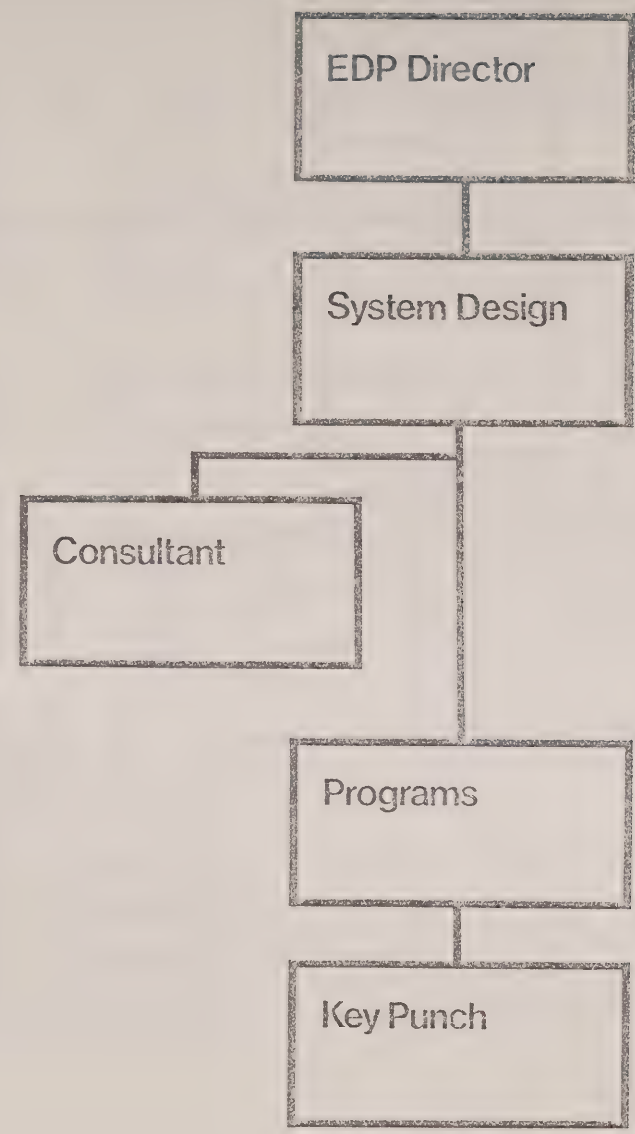
The Deputy Director of Property Equalization is appointed to carry out the policy decisions of the Director. The Deputy Director is responsible for specific management of the major areas of Equalization System. In this function, the Deputy reports directly to the Director and is responsible for the supervision and coordination of the Division Heads. The Deputy also oversees all consultant services.

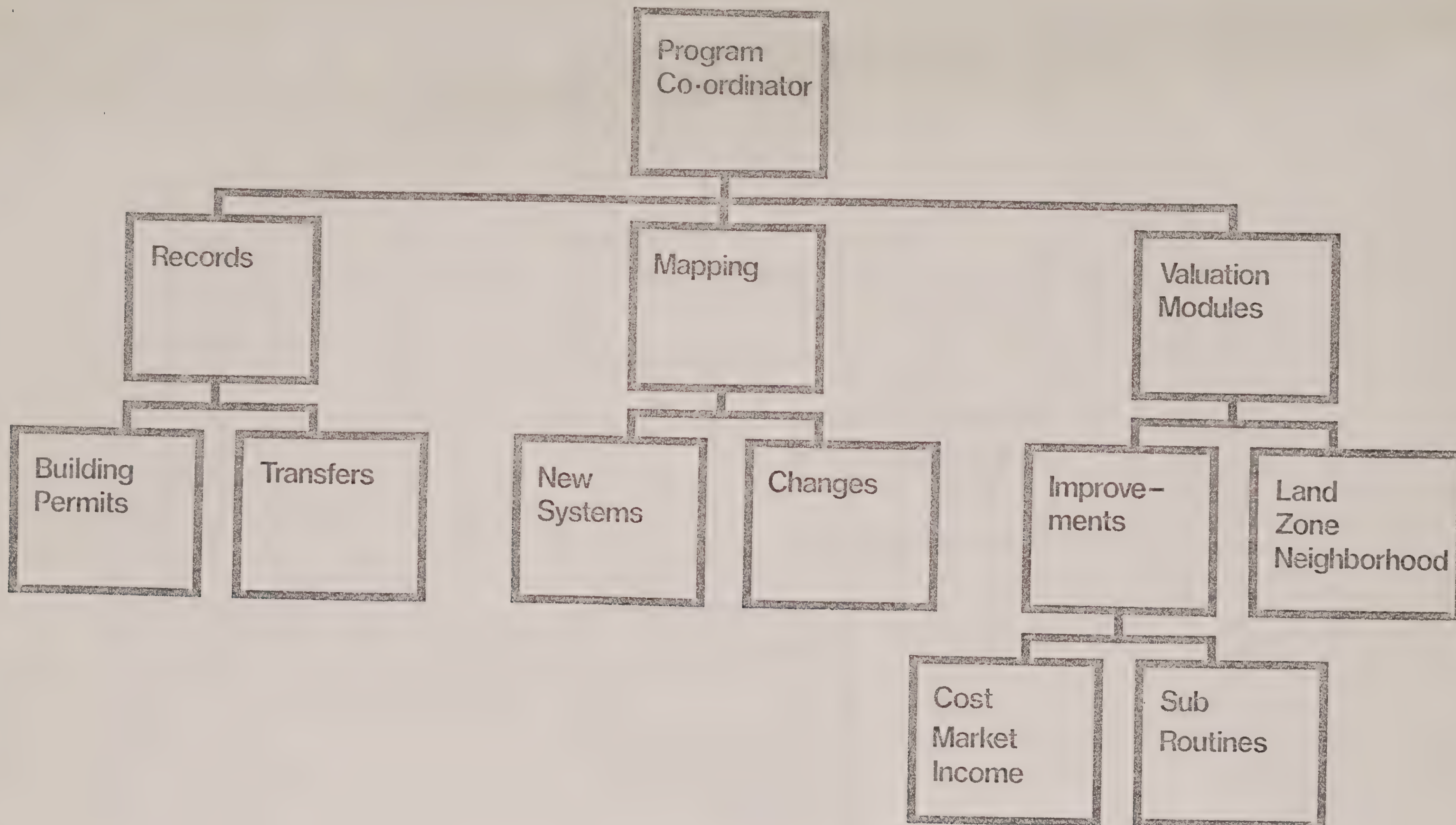
Due to the extensive automation of the system, it is recommended that there be an in-house Electronic Data Processing Division with a full compliment of staff. This division should utilize the services of expert consultants when necessary.

A Program Coordinator should be appointed to oversee the Analytic Units in-house operations. These include the areas of Valuation Models, mapping and analytic records.

A Data Collection Coordinator should be appointed to oversee the Data Collection Division whose operations include field data collection, verification, quality control and storage.

All work modules have been fully described in other sections of this report and should be consulted for establishing training programs for the various tasks and functions of the organization. The organizational structure of divisions follows:


EDP Director
System Design
Consultant
Programs
Key Punch


Program
Co-ordinator
Records
Mapping
Valuation
Modules
Building
Permits
Transfers
New
Systems
Changes
Improve-
ments
Land
Zone
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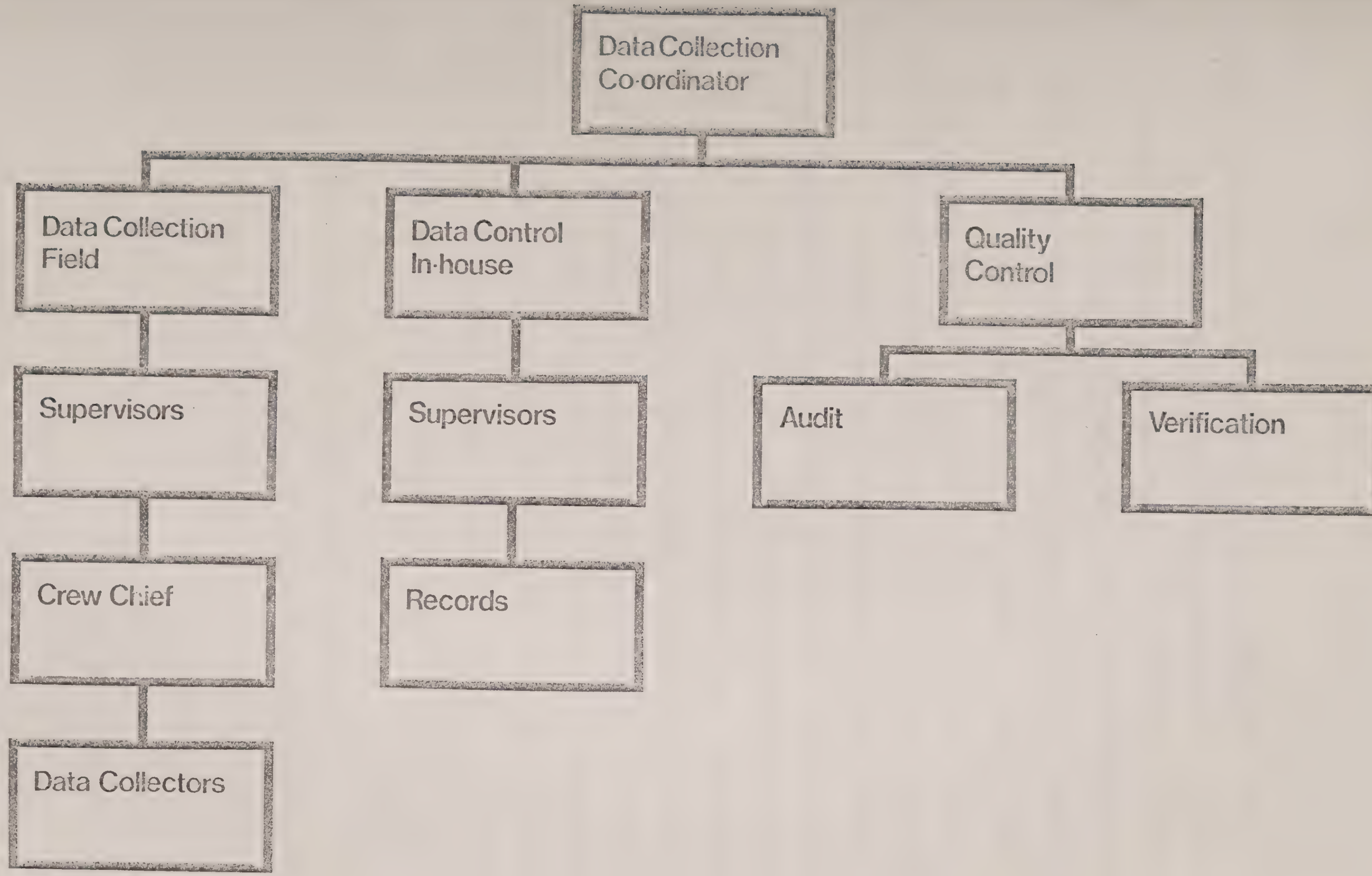
Cost
Market
Income
Sub
Routines



Data Collection Co-ordinator
Data Collection Field
Data Control In-house
Quality Control
Supervisors
Supervisors
Audit
Verification
Crew Chief
Records
Data Collectors

2. <u>Time and Phase Chart for Development of Equalization System</u>

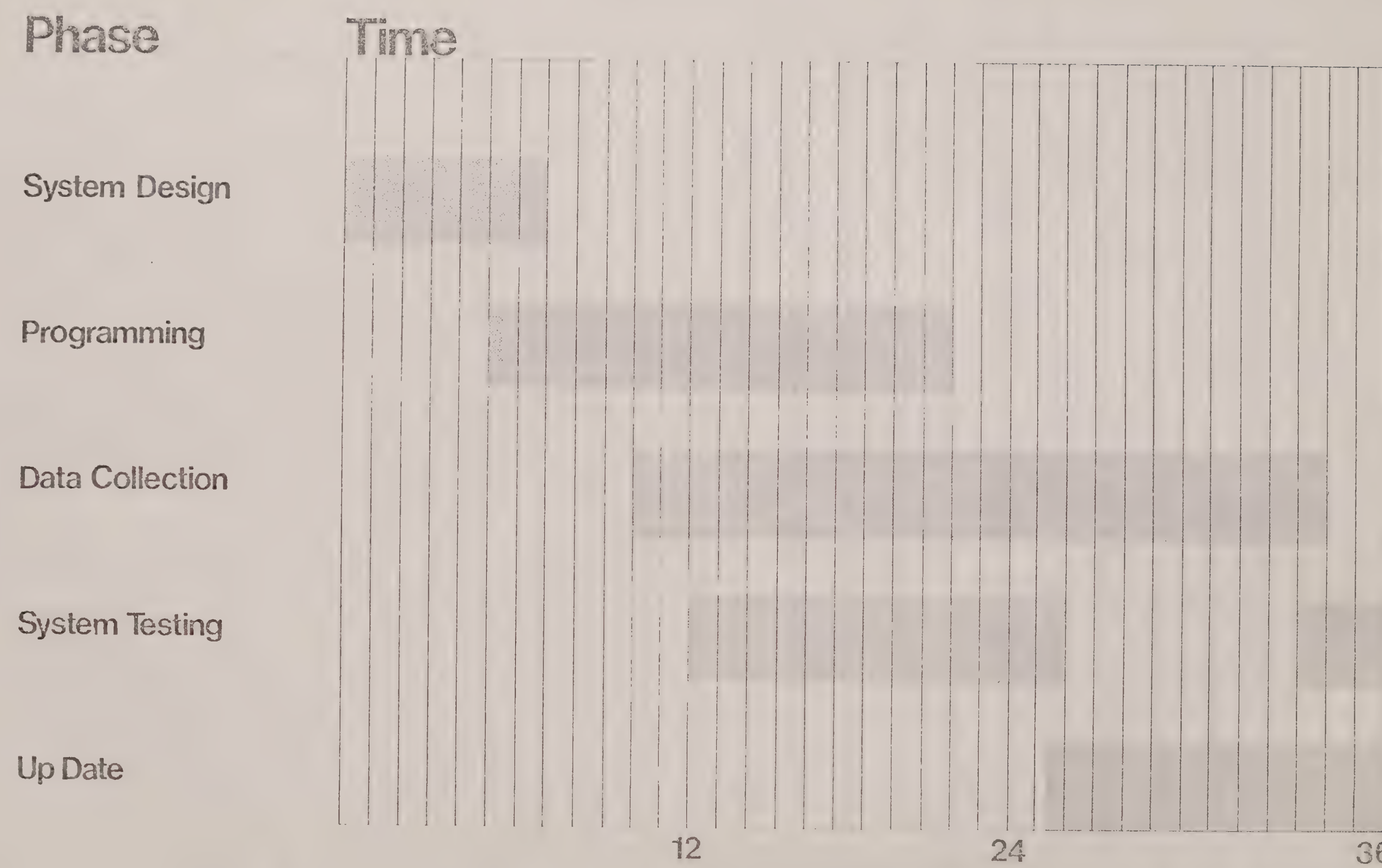
In the development of a time and phase chart, it must be recognized that certain phases of the project must be completed or started before other phases can begin (e.g., system design is a necessary step prior to computer programming). Consideration must also be given to financial resources and available personnel. But paramount consideration must be given to the proper management of the entire process. Judicious examination of the requirements for establishing efficient management procedures; for selection of personnel, for developing and implementing the appropriate training programs, for the maintenance of quality control at all stages of the process, for adequate management of consultant services; and for sufficient and ongoing analysis are an absolute necessity. This fact cannot be emphasized too strongly. If management of the process lags at any stage, the program could be set back for months, possibly years. The failure to record accurately during the Data Collection Phase, or an improper automated system design could necessitate a second Data Collection effort or a major system redesign.

The development of the Boston Equalization System will be a reiterative process. Much has been built into this Report to point out the major iterative steps, but in the process of developing the system many more will emerge. This constant testing and development is necessary, and of utmost importance in order to forestall disasters of the kind mentioned above.

The level of financial resources required is another consideration, since a shorter time period for development will increase personnel demands and project costs. Limited resources will dicate a longer time frame for development by reducing manpower requirements. On the other hand, if qualified manpower is not available, the time phase must be extended regardless of financial resources.

The following time and phase chart was developed after considering the logic and sequence for each phase, assuming reasonable staffing of the program in a manner that will ensure good management control. It is recognized that the time and phase chart can and will be altered as the project moves from this phase of master planning and into development. However, after taking into consideration the complexity of this project and the size of Boston as it relates to parcel type and number, it is the opinion of the consultants that the following time and phase chart as depicted is optimum for development of the progress.

Time & Phase Chart: Development of Equalization



2. Phase #2: System Operation and Maintenance

Once the Boston Equalization System has been developed and implemented to the point of producing property values, the system will be interfaced with and become a part of the Assessing Department of the City of Boston. The Assessing Department, under the direction of the Commissioner of Assessing, is a multi-function operation in the area of property taxation. In addition to real estate assessment, the office is responsible for personal property assessment, social services, tax abatements and other areas dealing with the total program of property taxation. The actual manner in which the system will be integrated with the Assessing Department must be developed in the last phases of the project. However, it is possible to list certain general requirements and considerations specific to the continued operation and maintenance of the Boston Equalization System. This discussion of administrative considerations follows.

Operation of the real estate equalization system requires the organization of personnel, equipment, and systems in a manner that will produce an equalized value for every parcel of real estate within the City of Boston on an annual basis. Therefore the Administrator must be concerned with the personnel, organization, and equipment which are related to the functioning of the system. This section of the report is designed to identify these areas of concern for the Administrator.

A. Organization

A key attribute of an administrator is his ability to organize those persons and functions within his realm of responsibility. A proper organizational structure sets up a chain of command, assigns responsibility and accountability to employees and identifies work modules.

In setting up an organizational structure it is helpful to separate work modules and identify communication patterns so that the Administrator may readily be in contact with progress reports from various divisions. It is additionally important that divisions within the system have structured procedures for cross communications as needed. For example, the Mapping and Land Valuation Units must be structured in a manner that would allow direct cross communication. In order that the organizational structure can be efficiently implemented, each position must have a job description which clearly defines the duties of that position.

B. Personnel Requirements

Establishing personnel requirements demands a delineation of each task in the Equalization System. The Administrator should identify each task by responsibility and duties, and also estimate probable workload. Then, the approximate requirements, by number of jobs to complete the overall function within a time frame required by the system or by law may then be estimated. The Administrator should designate minimum education, experience, and salary requirements necessary to attract qualified applicants for each job position.

The Assessing Department of the City of Boston is currently staffed and operating under job descriptions approved by the State of Massachusetts as Civil Service positions. A study should be initiated to determine if the current job descriptions and quotas will provide an adequate staff to operate the proposed equalization system and, if not, a program should be initiated in conjunction with the Civil Service Commission to correct the deficiencies that may exist in the present personnel structure.

According to a survey conducted by the International Association of Assessing Officers, 98% of real property appraisers are at least high school graduates, 72% have at least some college level education, and 26% are college graduates. Other analysis found a correlation between the percentage of college educated appraisal staff and the existence of more uniform appraisals. The probable reason as stated by the IAAO for this relationship is that college graduates are more likely to have the ability to absorb training and to make complex appraisal judgements. It would be foolhardy to accept a general conclusion that the employee educational background will guarantee more uniform appraisals. It should, however, be recognized that the Equalization System designed for the City of Boston will require a high degree of training and/or an advanced educational background for the employee to function efficiently in the new system. Educational requirements, experience requirements and continued educational expectations should be clearly stated in the job descriptions. Some positions can be clearly defined with regard to educational background. Other positions, due to the current unavailability of formal educational courses in mass appraisal techniques, will require training programs structured as on-the-job-training.

Salary levels which attract qualified people or encourage experienced personnel to remain are highly important. Salary schedules should be competitive and reflective of the educational and experience requirements in the job descriptions. One method to determine necessary salary levels is to conduct salary surveys for comparable assessment jurisdictions and on comparable position levels in private enterprise. The research department of the IAAO peroidically publishes salary data and will provide this information.

Once positions have been designated, classified and salary levels established, it will be necessary to determine the number of personnel required to operate the proposed equalization system. A general rule of thumb used in the assessment industry has been that one full time employee is required for each 2,500 parcels in the assessment jurisdiction. This is a general rule of thumb and may vary depending upon overall non-appraisal oriented responsibilities in the assessment office and the frequency of the assessment cycle.

Additional consideration must be given to the maintenance of the automated system. Fully implemented, the Boston Equalization System will be as sophisticated as any operating in the United States today. Therefore employee requirements should be based on equalization systems of comparable sophistication.

Based upon the consultants' experience and with our knowledge of the Boston System's requirements, the projection of staff requirements by division within the Assessing Department Real Estate Appraisal Section (for guideline purposes) is as follows:

DIVISION	TOTAL NUMBER OF PERSONNEL
Real Property Supervision, Appraisers, Clerical Support	83
Data Processing Systems, Programming and Keypunch	16
Abatement Supervisor, Clerical	12
Maps and Titles, Draftsmen, Jr. Drafting and Clerical	8
Total Personnel	134

C. Equipment

The publication "Standard of Equipment, Facilities, Supplies, and Procedures" published by the IAAO outlines equipment needs for jurisdictions by size and parcel count. The recommendation of that organization as delineated in the referenced publication are listed in the Addendum. It must be noted, however, that IAAO recommendations serve only as guides.

D. Automated System Operation

System Operation, as explained earlier in this report, involves the technical procedures for the valuation of all real estate located in the City of Boston. For a more technical discussion of valuation procedures, readers should refer to the appropriate section of the Report. However, for administrative considerations, the system should be viewed with regard to tasks that must be accomplished in the equalization of various class-type properties. Tasks, as required by the system, will be separated according to property types followed by a brief discussion of the purpose of each task and a graphic illustration on a work flow chart.

1. Residential Class (R1 - R3)

With implementation of the Boston Equalization System, it is recommended that the market oriented cost approach be processed on all residential properties. This approach may be supplemented by regression analysis. Due to limited availability of sales, it is recommended that the multiple regression program be reserved for spot checks until results indicate that the approach provides a reliable indication of value on a citywide basis.

Project steps for producing a market oriented cost approach are listed as follows:

a. Step 1: Market Oriented Cost Approach

Step 1 involves three separate simultaneous functions:

1. New Construction Listing

The development and implementation of the Boston Equalization System will require visiting each and every parcel in the City for the purpose of data collection. After the initial effort has been completed, data collectors will still be needed, but only for new construction. Automatic review of all building permits by the Assessing Department will provide information as to when and where new construction is occurring. The Building Department of the City of Boston has three types of building permits. They are for (1) new construction, (2) alterations, repairs or change of occupancy, and (3) demolition, ordinary repairs, and minor alterations not involving vital structural changes. The Assessing Department should receive all building permit information and begin new construction listing for updating purposes at the beginning of each year continuing until all new construction has been listed and the real estate data base has been updated. The responsibility for new construction listing should be assigned to the residential and commercial supervisors utilizing area supervisors and field appraisers by neighborhood assignment.

2. Land Valuation

Land Valuation represents an on-going program in the Assessing Department. Under the authority of the Land Valuation Unit, new sales and other techniques described in the land valuation section of this report should be continuously processed, posted and used to update previous land valuations.

3. Table File Analysis

Table files store market value indicators and are used throughout the appraisal system. These files contain information relating to Replacement Cost New, depreciation tables, land value, income and expense information, etc. Analysis of the table files is a necessary step each year to insure that the information contained provides a current indication of market value. Sub-routines within the equalization system will produce computer generated reports that may be used to update existing table files. Since table files are used by and interspersed throughout the three approaches to value, analysis of these files should be the responsibility of personnel familiar with the appraisal process and system flow.

Once new construction has been listed, land has been revalued, and table files analyzed and updated, the office is ready to produce a preliminary valuation role.

b. Step 2: Initial Valuation

After completion of Step 1 the Administrator is in a position to produce new values by the market-oriented cost approach. Step 1 does not cease at this point because these activities are ongoing. However, since new values will be produced at this point, any recommended changes resulting from Step 1 should be held and not entered into the data base or computer files until Step 6, below has been completed.

This step is composed of three separate functions as identified below. These functions are automated activities.

1. Replacement Cost New Less Depreciation is a program where the computer will compare the updated real estate base to updated table files and estimate value.

2. These RCNLD values are then compared by neighborhood to actual sales and modified by the Market Adjustment Factor to produce a market oriented cost value for the improvement.

3. Market adjusted, RCNLD is added to stored land values for an indication of total value by the market oriented cost approach.

c. Step 3: Performance Analysis

Performance Analysis involves checking the new values against actual sales to determine by Sales Ratio Analysis whether the target value level has been achieved. Several subroutines described earlier in this report may be processed at this time and will provide statistical information pertaining to value levels by property types and neighborhoods. Should the performance analysis produced indicate unacceptable results, it may be necessary to return to Step 1, make adjustments where necessary, and to produce new values which should again be compared to sales for statistical results. This step may be repeated as many times as necessary to achieve acceptable assessment levels and dispersion rates.

d. Step 4: Valuation Print Out

After the Administrator is satisfied with the Performance Analysis phase, the system will produce Computer Estimated Values (CEV) on all properties contained in the system. These values should be printed on soft copy and stratified by wards and map number. The printout should contain identifying information such as street address, property characteristics, etc., and assigned to area supervisors for completion of the Step 5.

e. Step 5: Valuation Field Check

Step 5 is a completely manual operation. Supervisors are provided a computer estimated value containing property characteristics and identifiers printed on soft copy. The Supervisors will make assignments to appraisers by neighborhood for the purpose for a Valuation Field Check. This process will vary in complexity depending upon the type of neighborhood under appraisal. Neighborhoods with a wide variety of property types may require a more detailed check than neighborhoods with a high degree of homogeneity. The appraiser will review the Computer Estimated Value as it relates to the property using his professional knowledge of the real estate market. The automated system is designed to appraise property at a typical standard, and in special cases, will need adjustment. Where exceptions exist (e.g., excess depreciation, unusual land conditions, individual property location problems or unique income and expense situations) the appraiser may override the system. Appraiser overrides, however, are the exception and not the rule.

For quality control, the Administrator must set up strict procedures for the approval of appraisal overrides and these changes should be monitored at all times.

f. Step 6: Final Updating

Step 6 involves final updating of the Real Estate Data Base and table files within the system. After commencement of Step 2, all changes produced by the continued operation of Step 1 must be held in storage. This final update step is to incorporate all changes occuring after Step 2.

g. Step 7: Final Valuation

In this step the final valuation estimates are processed. All changes reflected in the earlier steps will be incorporated in this estimate. After a final inventory to determine if all properties have been processed, this step will provide the basis for the assessment roll, property record cards, and tax bills.

The above steps are graphically depicted at the end of this section.

2. Residential Class (R 4 or more)

Multi-family residences shall include all residential properties containing four living units or more. Steps for the cost approach are basically the same as for single family residences as described in the previous routine. Additional information may be seen by viewing the chart at the end of this section. It should be noted that the new construction listing and land valuation sub-steps are assumed to have already occurred in this description. In addition to the cost approach, this type of property lends itself to the Income and Market Approaches to value. A brief discussion of the work tasks in these approaches follows.

a. Step 1: Initial Valuation Processes

1. Income Approach

Step 1 involves two simultaneous functions. Gross Income estimates for all properties must be updated annually. Procedures for this update are described in the Valuation Chapter of this Report. Table files containing expense information and capitalization rates must also be updated in a similar manner to Gross Income. Techniques for this process are also discussed in the Valuation Chapter.

After all table files for income and expenses have been updated and verified the income approach is then processed by the computer.

2. Market Approach

The Market Approach for this property type is arrived at by the Gross Income Multiplier (GIM) Technique. The Gross Income Multiplier is a factor derived by dividing the sales price of properties that have recently sold by their Gross Income Potential. The resulting factor can then be multiplied by the gross income potential of properties that have not sold to produce an estimate of value. The first step involves the manual analysis of sales to determine actual Gross Income Multipliers.

After Gross Income Multipliers have been determined by market analysis, the multipliers must be stratified by property types and stored in the computer table files.

The Market Approach is processed by the computer and utilizes the Gross Income stored in the appropriate data base which is multiplied by the appropriate Gross Income Multiplier for each class of property.

b. Step 2: Correlation of Initial Value Estimates

The value estimate produced by the computer for properties is a correlated value of the three approaches as previously described. It is an appraisal decision as to which approach provides the strongest indication of value. If all three approaches produce a close correlation, then the valuation estimate is representative of all three. However, in some cases, due to a lack of market information, one approach may be weighted in relation to the others. Any combination of the approaches must be based upon an informed appraisal decision.

c. Step 3: Performance Analysis

This procedure corresponds to Step 3 described for single family residential properties above, and should be repeated until the value estimate is within acceptable statistical tolerances.

d. Step 4: Valuation Printout - This and the following steps correspond to the steps under Single Family Residential (above).

e. Step 5: Valuation Field Check

f. Step 6: Final Updating

g. Step 7: Final Valuation

3. Commercial/Industrial Property

Commercial and Industrial property will be valued by two value approaches, the cost approach and the income approach. Steps for these approaches were discussed in the Valuation Chapter and will not be delineated here. A graphic illustration is depicted following this section.

It is anticipated that sales will be limited in this class of property. However, in order that market information on commercial and industrial properties may be monitored by the appraiser, it is recommended that sales should be retrieved from the sales file and listed by location and property type. This information will be provided to the appraiser for guidance in the field check step of the valuation process.

4. Unique Properties

The computer system has been designed to provide computer generated values on a majority of properties in the City of Boston. For various reasons, some properties are unique in nature and do not lend themselves to computer application. When this situation exists, the computer will maintain or print out an "edit list" for unique properties that will require individual handling. Unique property valuation should be the responsibility of area supervisors. Manual steps are as follows:

a. Step 1: Listing

New construction is listed from building permit information and field visits. This information is stored on a property record card.

b. Step 2: Land Valuation

Land values should be a responsibility of the Land Valuation Unit and furnished to the individual appraiser.

c. Step 3: New Construction Update

New construction update is indicated by building permit activity.

d. Step 4: Initial Valuation

Initial valuation estimates are arrived at through applicable valuation approaches and entered on the Property Record Card.

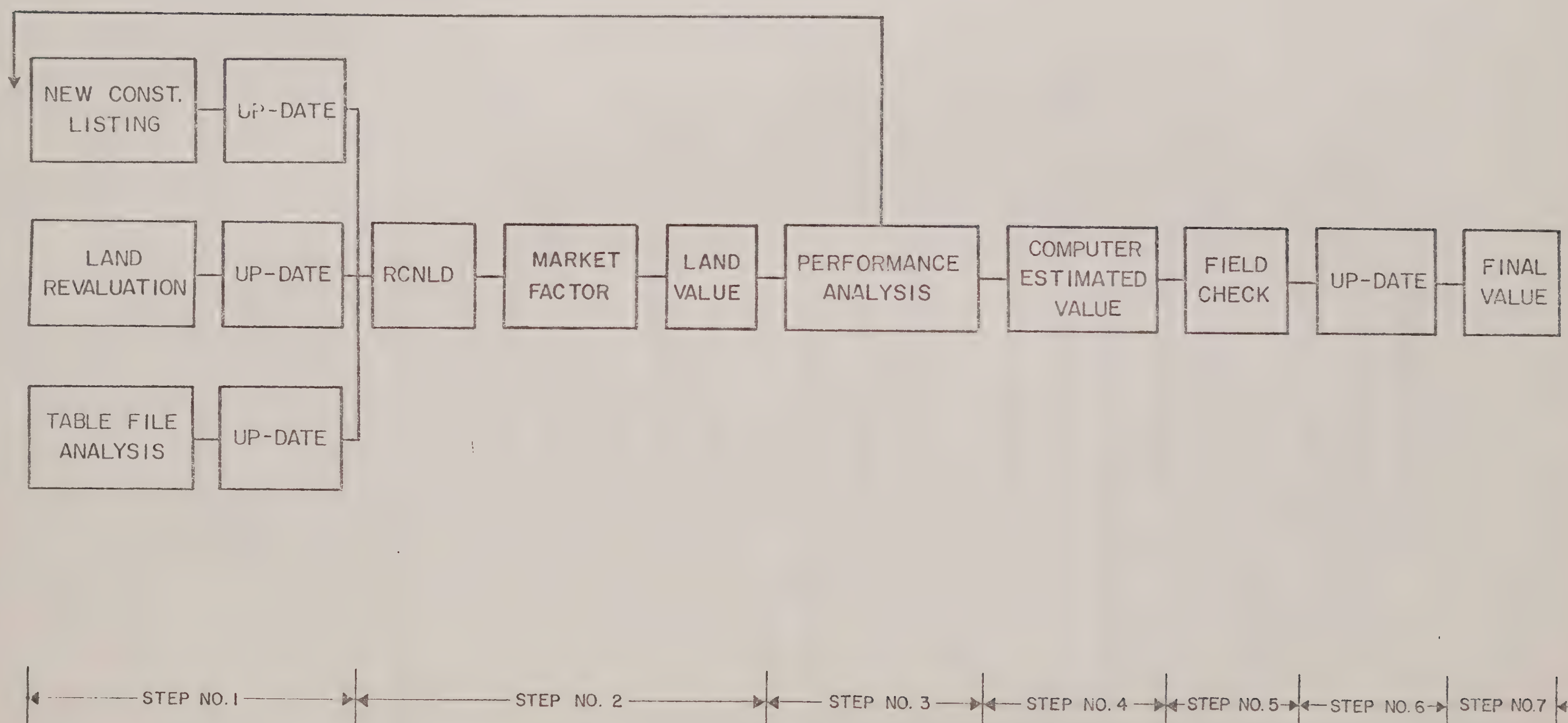
e. Step 5: Field Checking

Field checking by the appraiser for verification of the final value estimate.

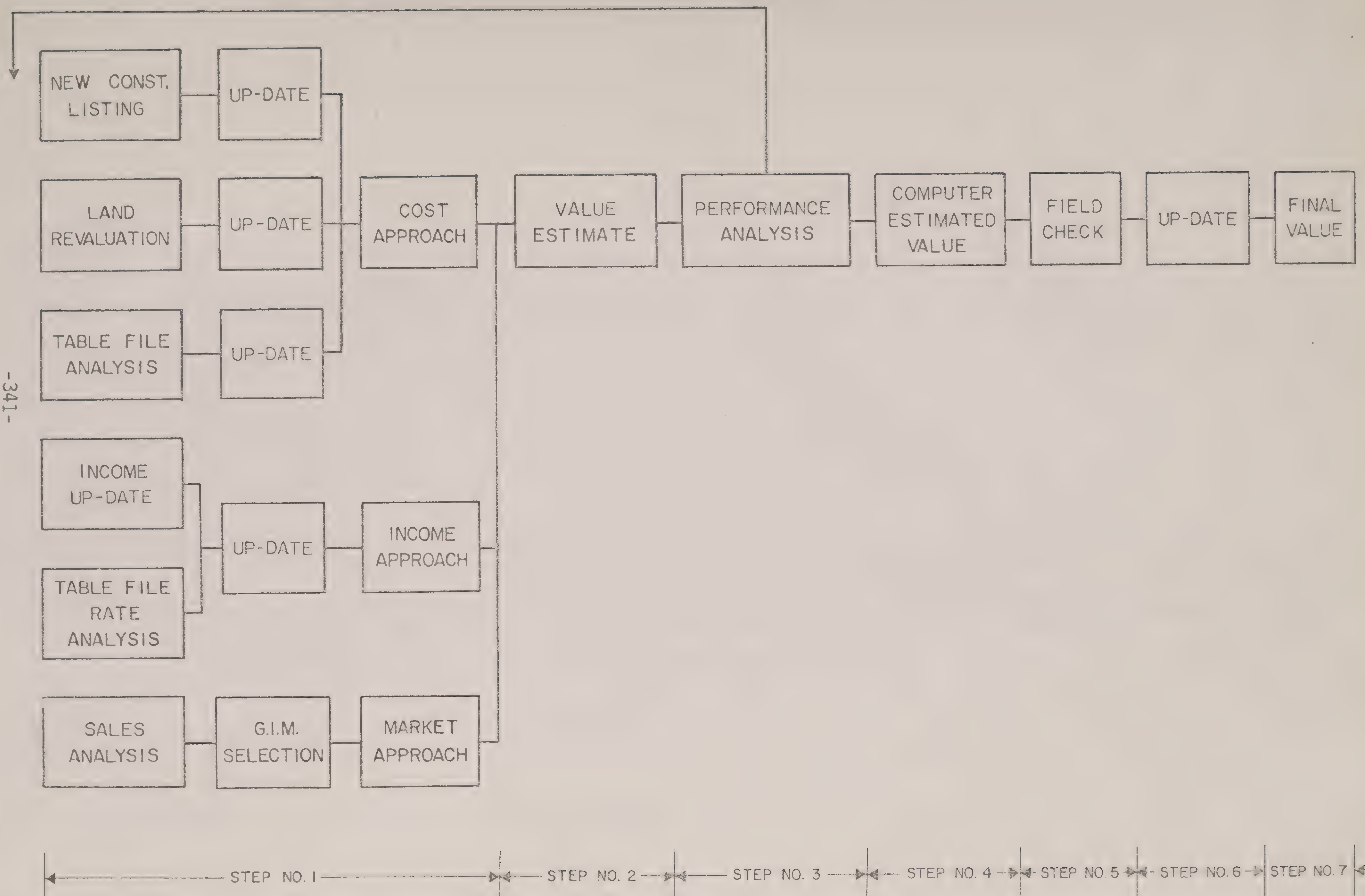
f. Step 6: Final Valuation

Final value estimate is produced.

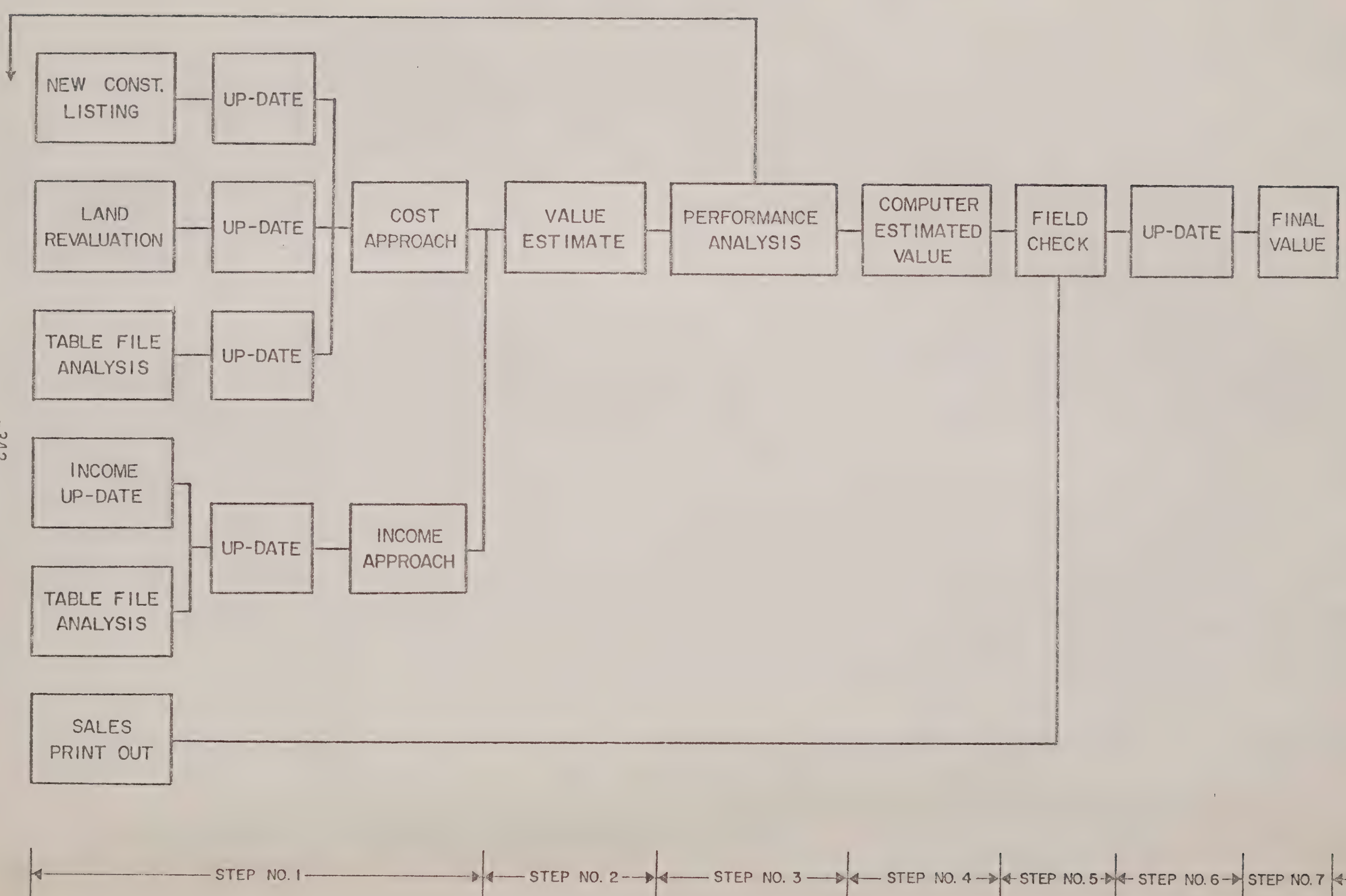
RESIDENTIAL CLASS (R-1 - R-3)



RESIDENTIAL CLASS (MULTI-FAMILY)



COMM./IND. PROP.



UNIQUE PROPERTIES